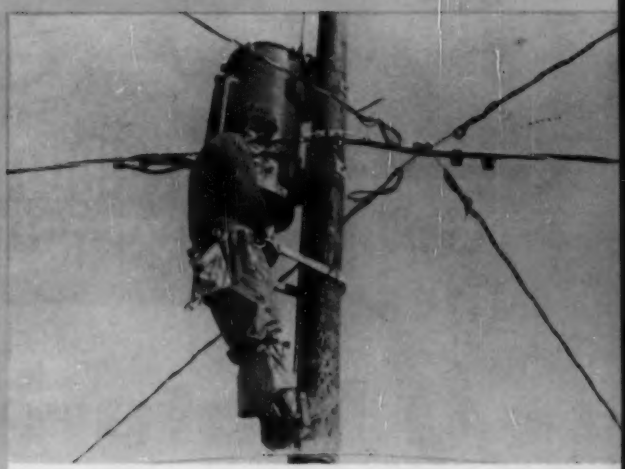
JULY 11, 1955

Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION



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ALLIS-CHALMERS

DISTRIBUTION TRANSFORMERS

Get These 6 Features

1 High Voltage Sidewall Bushing Has Safety-Designed hand-knob which can't be unintentionally removed, positively prevents touching "hot" parts. No more splicing: connector grips *two* standard conductors as large as No. 2 stranded cable at same time. Conductor can't slip or twist. Use either copper or aluminum wire.

2 Low Voltage Bushing Has Double Key Design to provide positive protection against rotation, eliminate a cause of internal short circuit and maintain effectiveness of seal. Use either copper or aluminum wire. Corprene gaskets are fully retained, are compressed without twist or shear.

3 Tank Bottom Is Recessed with Straight Wall inside and out — there is no place for water to collect. Cover and tank have horizontal gasket surface to assure proper gasket compression with no possibility of shear. Cover clamps are captive, will not drop to ground when loosened. All tanks pressure-tested at 50 psi.

4 Coils Are Locked Firmly with adjustable coil supports. Pad under support distributes pressure evenly. Pad is of specially compounded alkyd polyester impregnated glass fiber for extra strength.

5 Improved Surface Protection because hot spray paint method puts paint, not solvent, on transformers. You get even flow of high content, specially developed alkyd resin enamel that provides a smooth surface with high gloss and thorough coverage.

6 Shipping Crate Provides Pallet as Bonus. After transformer is removed from crate, the pallet bottom can be used for other materials.

A-4778

See these advantages for yourself in Allis-Chalmers Visualizer kit. Your nearby A-C office representative can show it to you. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

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Electrical World

Published for 81 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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COMING NEXT WEEK—How cooling towers are becoming increasingly important in the selection of steam power plant sites.

This advertisement reproduced the results of tests made on an Okonite-Callender paper-insulated cable in 1949.

The advertisement reproduced here appeared five years ago. The story it told then remains true today—that is, that the first length of lead-sheathed cable furnished with an Okosheath Protective Covering back in 1933 is still operating successfully in a highly corrosive location. Since then, many hundreds of thousands of feet of cable protected by Okosheath Protective Covering have been installed, AND WE HAVE YET TO RECEIVE A REPORT THAT A SINGLE LENGTH HAS FAILED BECAUSE OF CORROSION.

Today over half the lead-sheathed paper cables supplied by Okonite have Okosheath Protective Coverings specified by the user—not only to protect against corrosion and electrolysis, but to reduce the danger of sheath scoring during installation.

When the Okosheath Protective Covering is used in combination with an Okometal alloyed sheath, the composite construction permits a reduction in the thickness of metal required, and a corresponding saving in cost. Wherever a paper power cable is required, the advantages of Okonite's composite sheath should be considered. Detailed information may be obtained by writing for Bulletin EW-1047. The Okonite Company, Passaic, N. J.

1859-A

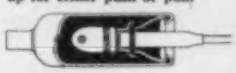
OKONITE SINCE 1878 *insulated cables*

10,000 FEET OF CONDUIT RODDED IN 8 HOURS!

Pick-up and Leader fittings meeting

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.



EASY DOES IT!—It's all in a day's work with Electroline Steel Duct-Rodding Equipment rodding 10,000 feet of conduit!

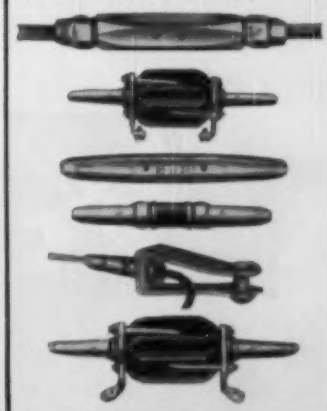
Light in weight, easily handled and stored, low upkeep: these are a few of the advantages utility men know to be true. But even bigger, more important advantages are—

- *Savings in the cost of labor*—for example, where it formerly took two gangs from one to two weeks on a given job, one gang, *in one-half hour*, has completed the same job—using Electroline Duct-Rodding Equipment.
- *Savings in original cost*—you get long life—double that of other types—when you buy Electroline Duct-Rodding Equipment. Add to that this fact: this equipment costs just about half as much for equivalent capacity! *There's true economy.*
- *Savings in Total Investment*—fewer sets are required because of the speed with which a job is completed and the equipment moved to other locations.

Speed up installation, reduce your costs; start now to use Electroline Duct-Rodding Equipment. Available for 3", 3½" or 4" Duct.

We've got a 4-page brochure which describes and illustrates more completely how this equipment can benefit you. We'll gladly send you a copy. Write us.

OTHER *Electroline* PRODUCTS



Electroline Company

4121 South La Salle St., Chicago 9, Ill.
In Canada: POWERLITE DEVICES, LTD., TORONTO

PREPARE NOW FOR TOMORROW'S IN SWITCHING DISTRIBUTION

It's a matter of simple addition to get this modern device for the switching of distribution feeders . . . because an S&C Load Interrupter consists of an interrupting unit added to a disconnect switch.

And with an S&C Load Interrupter you can switch the modern way. You can drop the load—all of it—at once. No need to go through complicated unloading preliminaries—no need to open main breakers causing otherwise unnecessary interruptions. Outages are held to a minimum—line repairs can go forward immediately.

In addition, you can switch the circuit any time under any condition (except short circuit) . . . valuable protection against inadvertent operation or operation under emergency conditions. Switching with S&C Load Interrupters cannot lead to dangerous phase-to-phase or phase-to-ground faults. It cannot endanger men or equipment because there is no external arc.

If you've been delaying the use of S&C Load Interrupters because of budgets, remember that you can install S&C Convertible Disconnects *without* the interrupting units at the same price as conventional disconnects. Then, when you're ready to convert, you can quickly install the low-priced interrupting units with a hot line tool *without de-energizing the circuit.*

Ask your nearest S&C sales representative for information.

S&C

Specialists in High-Voltage Circuit Interruption since 1910

S&C ELECTRIC COMPANY

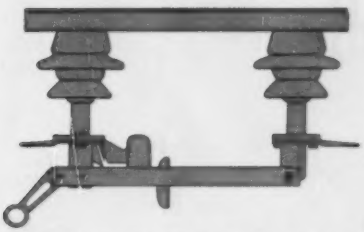
4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.

In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

PROBLEMS

FEEDERS

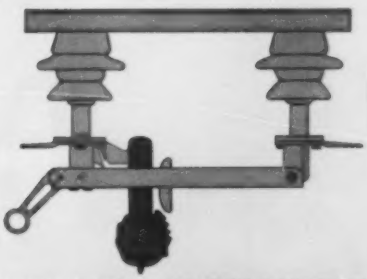


S&C CONVERTIBLE DISCONNECT

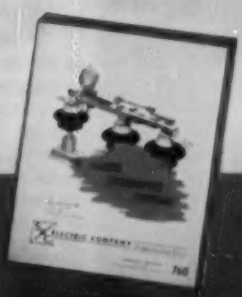
plus

INTERRUPTING UNIT

Equal



S&C LOAD INTERRUPTER



Catalog Section 760 tells in detail how the S&C Load Interrupter improves operating practices and saves money.

No Tools

To change ratio on this metering outfit — just turn the handle

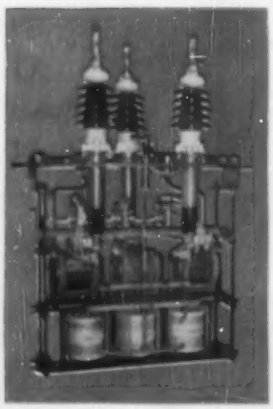
Half a minute instead of half an hour. That's the amount of time you save with Allis-Chalmers metering outfits equipped for *external* ratio changing. Only Allis-Chalmers provides this time-saving convenience.

External ratio changing is safer, too, because it permits floor-level operation. Just de-energize the circuit and rotate the handle. All phases are changed simultaneously.

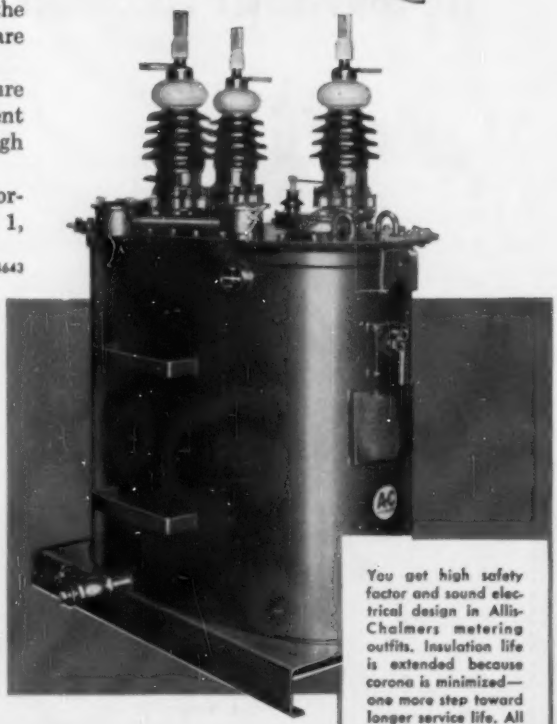
External ratio changing is a standard feature on all Allis-Chalmers metering outfits for current ratings up through 200/400 amp, 15 kv through 69 kv.

Call your nearby A-C office for complete information. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4643

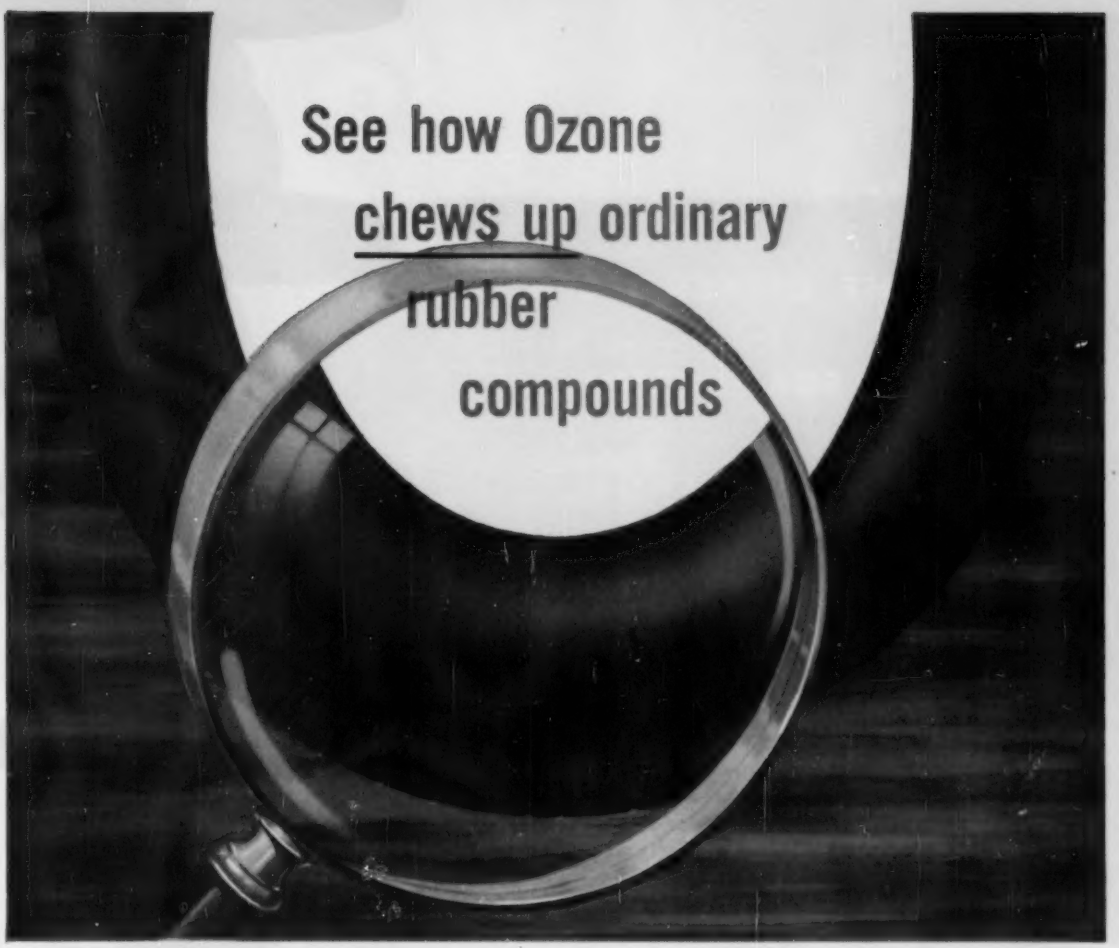


Service-proved ratio changer is the same rugged "point contact" mechanism used on Allis-Chalmers power transformers. Contacts are self-aligning. Contact pressure is equal and positive; it is increased as a result of magnetic forces due to current flow. A single current path is established by round point contact under high unit pressure against a flat stationary surface. This strong wiping action cleans surfaces for good contact.



You get high safety factor and sound electrical design in Allis-Chalmers metering outfits. Insulation life is extended because corona is minimized—one more step toward longer service life. All metering outfits are furnished with double current ratings to provide for future load growth.

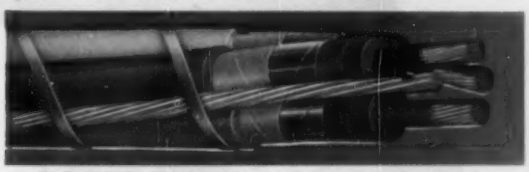
A-C ALLIS-CHALMERS



but not U. S. Grizzly Uskorona-insulated power cables

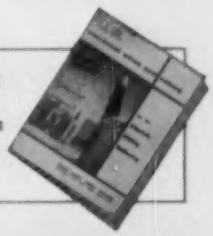
Here's an illustration showing how ozone can chew up a sturdy, rugged cable. This can never happen with United States Rubber Company's famous Grizzly® power cables, insulated with Uskorona® compound which prevents electrical failure caused by ozone (Uskorona-1 oil base compound and Uskorona-2 butyl base compound). Uskorona meets (and in many ways exceeds) the applicable IPCEA specifications for ozone-resistant rubber insulation.

U.S. Grizzly ozone-resistant power cables are typical of the wires and cables "U.S." develops to meet the ever-increasing rate of expansion of electrical generation and construction. "U.S." is always ready with new products to meet new demands and is always developing, as a matter of policy, wires and cables that are more economical because they are more serviceable.



U.S. Grizzly Uskorona-insulated Power Cable, 15,000 volts, Type RR, 3 conductor, shielded, Neoprene jacket

Send for free illustrated book giving full information about U.S. Electrical Wires and Cables for the Electric Utility Industry.

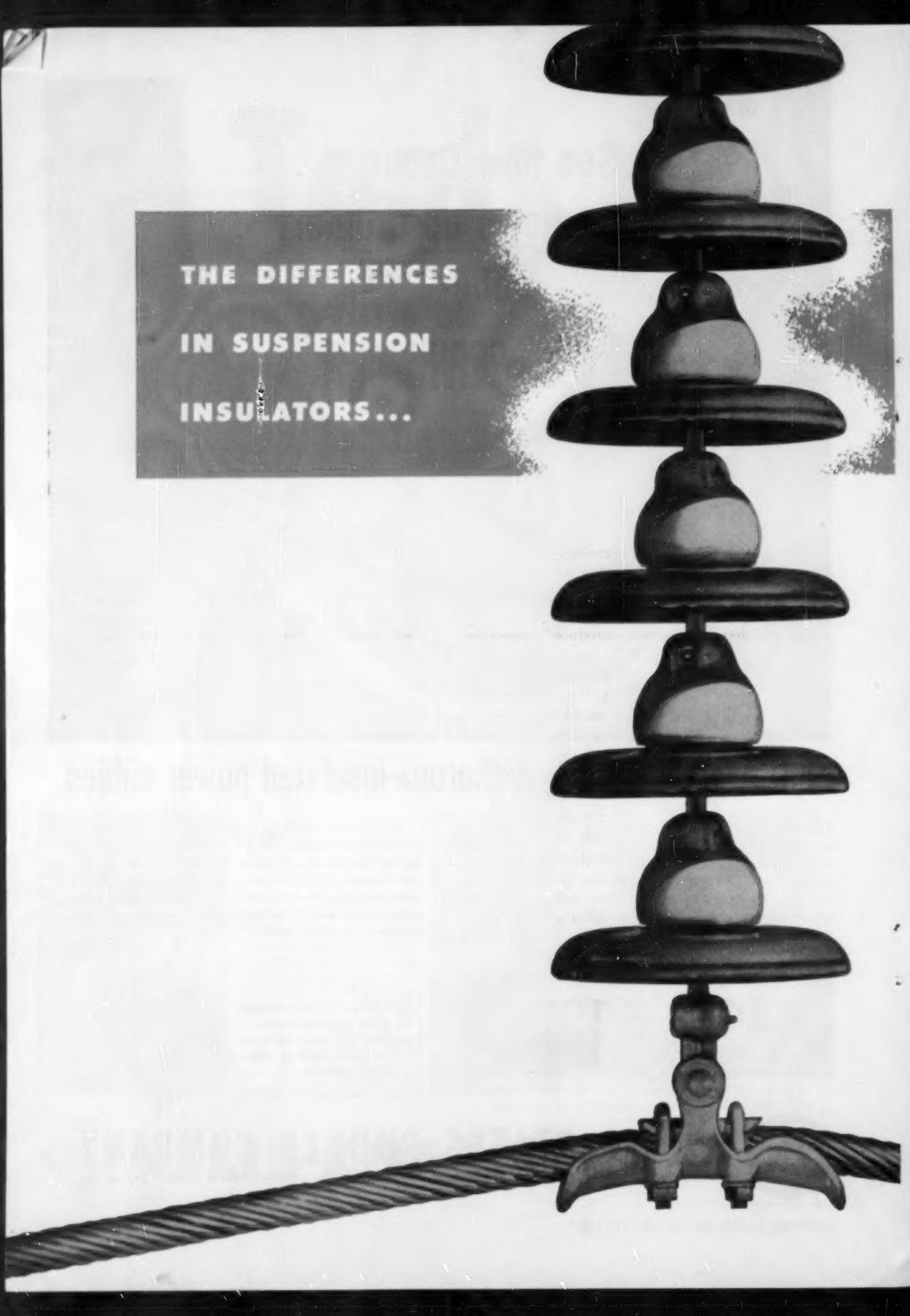


US RUBBER

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE & CABLE DEPARTMENT, ROCKEFELLER CENTER, NEW YORK 20, N. Y.

THE DIFFERENCES IN SUSPENSION INSULATORS...



. . . ARE IN THINGS YOU DON'T SEE IN "STANDARD SPECIFICATIONS"

NEMA Standard specifications for a suspension insulator call for a disc 10" in diameter, with 11½" of leakage distance, an M & E strength of 15,000 lbs.

If that's all it takes to produce "acceptable" suspension insulators, we've wasted a great deal of money and skilled effort at Lapp! Our continuing research, development, and control programs are dedicated to the positive knowledge that *there is a difference* in suspension insulator quality—and to the end that the differences will be on the side of users of Lapp suspension insulators.

We know of the improvement in our own product we have been able to effect in 35 years. We know how trifling variables in raw materials or manufacturing procedures can result in major differences in finished product. We know that uniform electrical and mechanical characteristics of porcelain, hardware quality, and proper assembly, are not matters of chance—nor even of habit.

And we know, too, that after a few years of service, insulators may not have the same characteristics as when shipped from the factory. Because modern construction practices protect insulators, it is possible for lines to stay in service with a dangerous proportion of insulators which will reveal their hazardous condition only under severe electrical or mechanical emergency.

Lapp insulators are more than "good enough to meet specification." They are good enough to offer a positive extra margin of operating safety and security . . . long life . . . and low upkeep. Many of America's best transmission companies have service records to prove it is so.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

NEW UTILITY STATIONS C-E EQUIPPED

Includes only new stations on new sites placed in operation since the war (in white) and those under construction or being engineered.

TIDD • JENNISON
CECIL LYNCH • HAVANA
MEREDOSIA • PERMIAN BASIN
O. H. HUTCHINGS • REX BROWN
HICKLING • B. C. COBB
RUSSELL • SEWAREN
POSSUM POINT • CUTLER
PORT JEFFERSON • WHITE RIVER
POTOMAC RIVER • GADSDEN
W. SPRINGFIELD • WOOD RIVER
DAN RIVER • LAKE CATHERINE
HARRY NEWMAN • JIM HILL
HUTCHISON • YATES
DUNKIRK • TITUS • LEE
CONTRA COSTA • HAWTHORN
NINEMILE POINT • EDGE MOOR
PALATKA • JOHNSONVILLE
DANSKAMMER • BECKJORD
HIGHGROVE • PLANT X
BLACK DOG • ALBANY
JOPPA • MERAMEC
PORTSMOUTH • LAKE CREEK
ETIWANDA • AURORA
HENNEPIN • EASTLAKE
OAK CREEK • SUWANNEE RIVER
URQUHART • KINGSTON
SANDOW • MULLERGREN
BARRY • NORTH OMAHA
WILMINGTON • CARBON
SAGUARO

MORRO BAY

VERMILION
MILLIKEN
GALLATIN
JOHN SEVIER
BARRETT

NEW MORRO BAY

recently dedicated

When the Morro Bay Steam Plant of Pacific Gas and Electric Company was dedicated recently, a new, important link was added to the ever-expanding power generating facilities of that leading utility company.

An interesting feature of this station is the fact that it employs evaporated sea water for feedwater makeup. The Morro Bay site, desirable in other respects, lacked adequate fresh water supply. Careful studies of alternate sources established the practical and economic advantages of using sea water conversion.

The Morro Bay Station this year adds 150,000 kw of new capacity at the southern end of the extensive Pacific Gas and Electric Company system to meet growing demands in that area. A second unit of similar capacity is presently under construction and is scheduled for service next year. The Bechtel Corporation is the Engineer-Constructor.

Steam for both the generating unit now in service and the second unit referred to above is supplied by C-E Boilers, a cross-sectional elevation and brief description of which appears on the opposite page.

COMBUSTION ENGINEERING

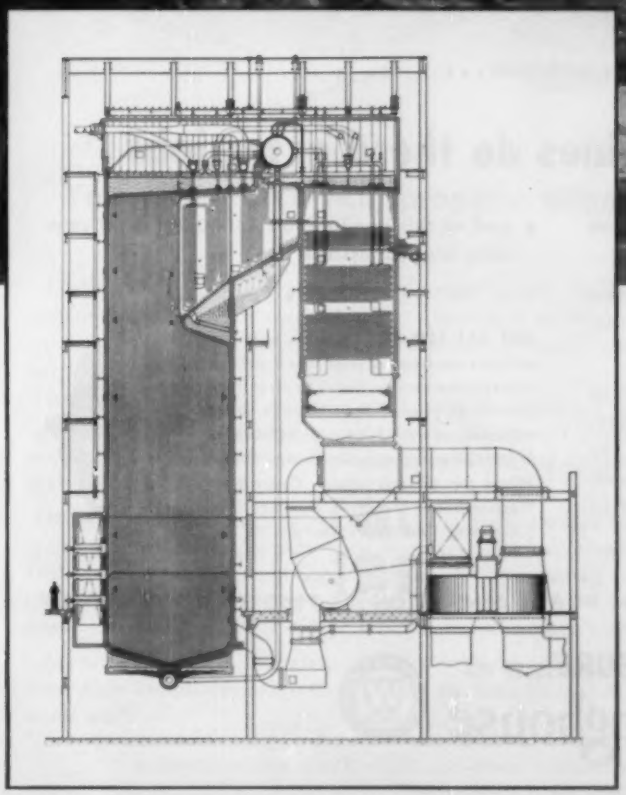
C-E

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

B-851

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE

STEAM PLANT



Shown at left is the C-E Unit now in service at the Morro Bay Plant. It is of the radiant-reheat type with a reheater section located between the primary and secondary superheater surfaces. An economizer section is located below the rear superheater section and regenerative type air heaters follow the economizer surface. These units are designed to supply steam at 1800 psig with primary steam temperature of 1000°F, reheated to 1000°F. They are designed for oil firing with provision for future use of natural gas or pulverized coal.

FACTS on Westinghouse 5000-kw gas turbines . . :

Westinghouse gas turbines do these extra jobs

Here's how Westinghouse gas turbines can save you money when used with steam turbines:

- Hot gases exhausted by the gas turbine can heat feedwater. This removes extraction load from the steam turbine, raising its capability.
- Exhaust from gas turbines contains almost as much oxygen as free air so it can be used as preheated combustion air for fuel-fired boilers. The 5000-kw gas turbine can supply enough combustion air for a boiler with a capacity of 400,000 pounds of steam per hour.
- And all this in addition to 5000 kw more capability for your system.

• • •

GET ALL THE FACTS about how gas turbines can work in your steam turbine plant to save money. Call *The Man With The Facts,* your Westinghouse sales engineer, or write for a copy of booklet B-5887, *Westinghouse Gas Turbine Power Plants for Electric Power Generation.* Westinghouse Electric Corporation, 3 Gateway Center, Pittsburgh 30, Pa.

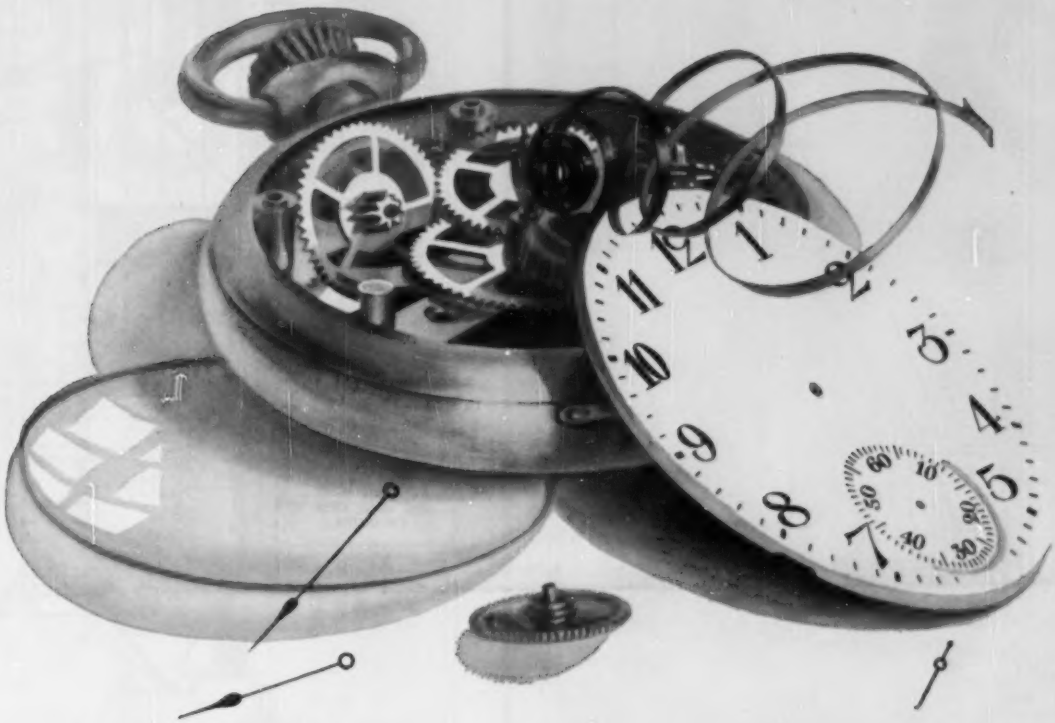
J-50572

GAS TURBINE POWER PLANTS FOR ELECTRIC POWER GENERATION . . . 1250 KW TO 15,000 KW

YOU CAN BE SURE...IF IT'S Westinghouse

Everything a watch should have

—except the tick!



Your plant can't "tick" properly, either—without Correct Lubrication!

Like this watch, your plant may have all the right "parts"... the finest machines made... yet may not be "ticking"—running at top efficiency—because something is lacking. That "something" is called *Correct Lubrication!*

By Correct Lubrication we mean much more than just "oil" and "grease"—which any oil supplier can provide. We mean a detailed *program* of lubrication—designed specifically for your kind of machinery and type of operation.

Working with your personnel, we analyze all your machines and their operating conditions to determine their exact lubrication requirements. Then we recommend the *right* Gargoyle product for every moving part, advise on correct methods of application, set up proper lubrication schedules, follow up regularly with progress reports on benefits achieved.

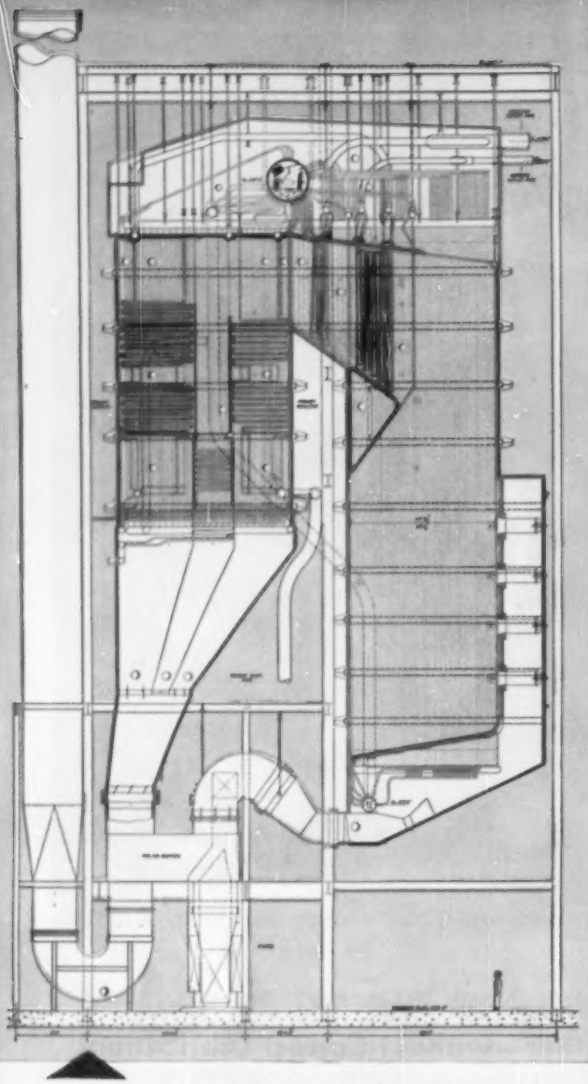
In plant after plant, such a program has effectively boosted production—materially cut maintenance costs. It can do the same for you. Why accept less?

Socony Mobil

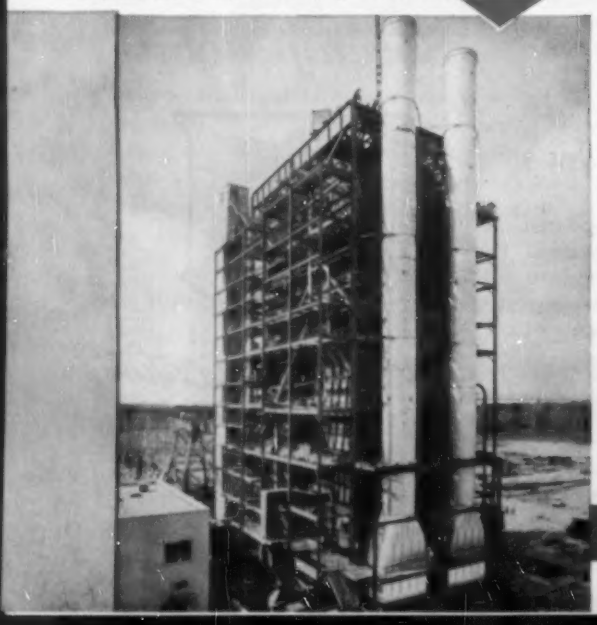
Correct Lubrication

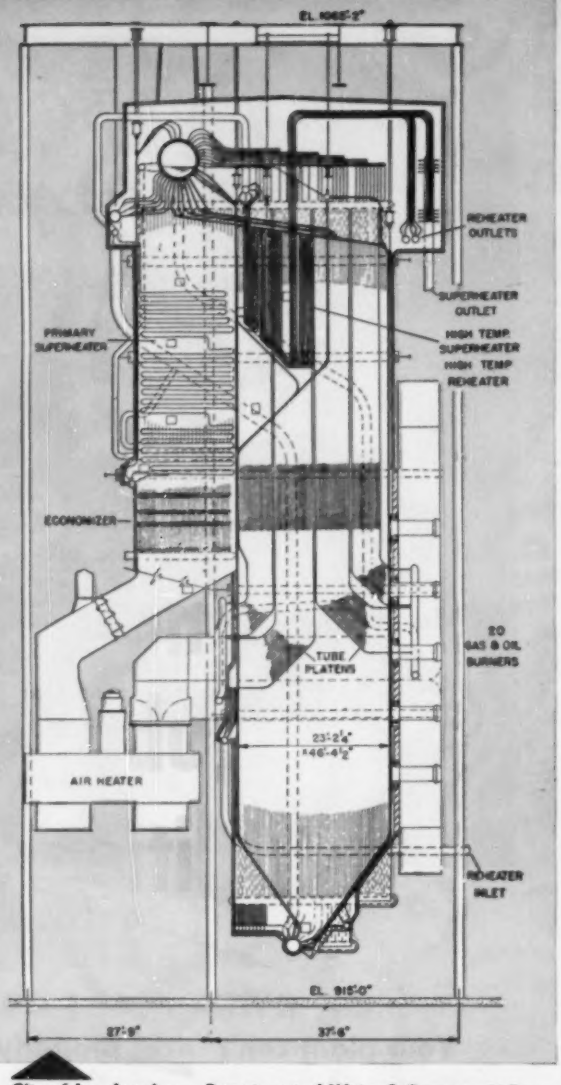
FIRST STEP IN CUTTING COSTS

SOCONY MOBIL OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION
Formerly Socony-Vacuum Oil Company, Inc.



Louisiana Power & Light Co., Nine Mile Point Station — Ebasco Services, Consulting Engineers — 1-1,000,000 lbs/hr reheat unit with pressurized furnace — 1725 psig; 1005F/1005F Reheat.





City of Los Angeles — Department of Water & Power — Valley Steam Station 2-1,200,000 lbs/hr reheat units - 2075 psig; 1000F/1000F Reheat.

The acceptance of Riley for big reheat and pressurized units by the public utilities . . . the marked swing to Riley has been brought about by outstanding design characteristics such as those found in these three Riley units . . . low furnace exit temperatures through the use of radiant surface preventing objectionable slag formation; wide load range with stable ignition with damper or a combination of damper and spray control; high yearly net efficiency, dependability, and continuity of operation.

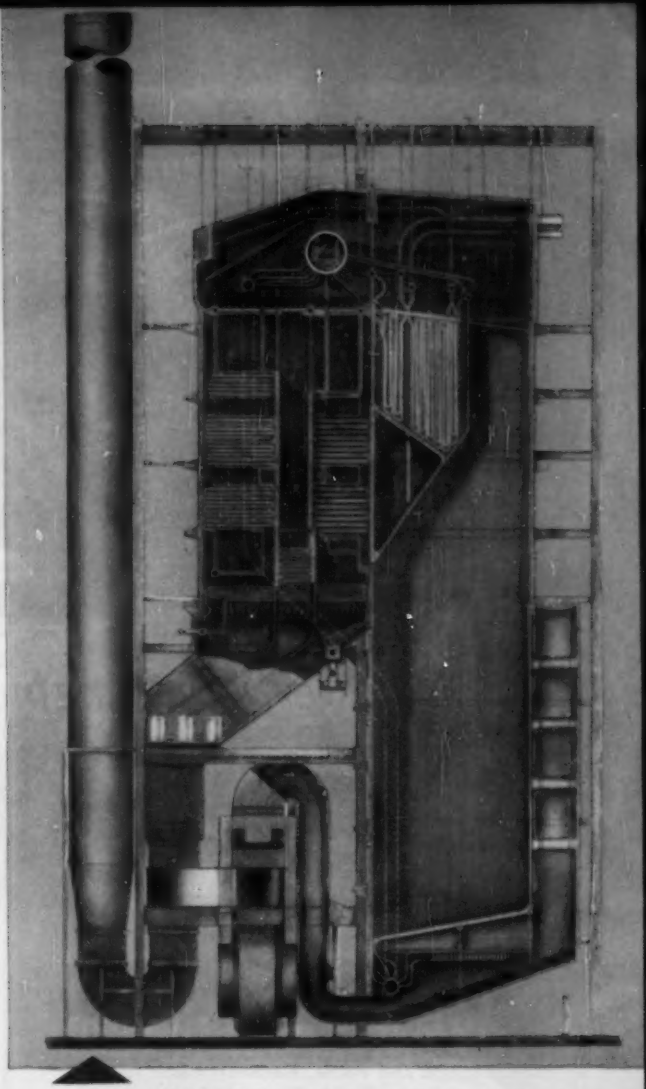
A survey of your power plant by your consulting engineer will possibly show ways of making surprising savings in your power costs. There is a Riley representative in all principal cities.

RILEY STOKER CORPORATION • Worcester, Mass.

COMPLETE STEAM GENERATING UNITS AND

for the BIG JOBS more and more public utilities

rely on



Houston Lighting & Power — Deepwater Station and Sam Bertron Steam Electric Station — Ebasco Services, Consulting Engineers — two 1,250,000 lbs/hr reheat units with pressurized furnaces — 2125 psig - 1005F/1005F Reheat.

RILEY

All of these public utilities have purchased Riley Steam Generating Equipment.

†Dallas Power & Light Co.
†*Texas Electric Service Co.
†*Houston Lighting & Power Co.
*City of Los Angeles, Dept. of Water and Power
†*Louisiana Power & Light Co.
Monogahela Power Company
Potomac Edison Co.
West Penn Power Co.

Arkansas Power & Light Co.
*Utah Power & Light Co.
†*Florida Power Corporation
Florida Power & Light Co.
*Central Illinois Light Co.
†Southern Nevada Power Co.
†*Central Louisiana Electric Co.
Northern States Power Co.
Philadelphia Electric Co.

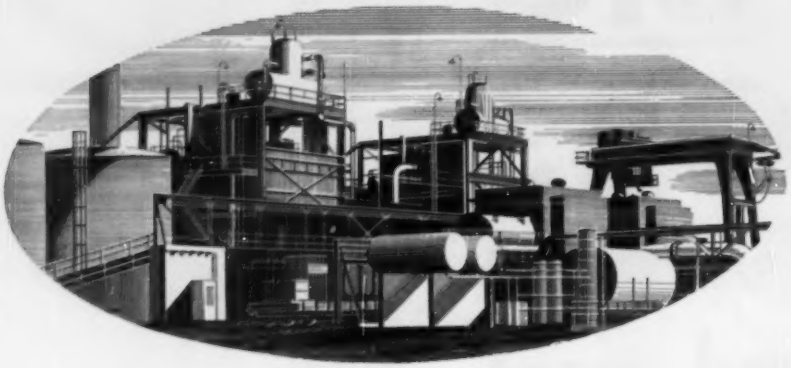
Commonwealth Edison Co.
Northern Virginia Power Co.
Gulf Power Co.
Pennsylvania Electric Co.
Interstate Power Co.
Ohio Edison Co.
Montana-Dakota Utilities Co.
Mississippi Power Co.
Otter Tail Power Co.

†New Orleans Public Service Co.
†Southwestern Gas & Electric Co.
*Public Service Co. of Indiana, Inc.
Columbus & Southern Ohio Electric Co.
South Carolina Electric & Gas Co.
Southwestern Public Service Co.
Union Electric Co. of Illinois
*Dairyland Power Cooperative
Iowa-Illinois Gas & Electric Co.

*Reheat †Pressurized

FOR BOILING EQUIPMENT FOR PUBLIC UTILITY AND INDUSTRIAL POWER AND HEATING PLANTS

Fluor assumes undivided responsibility



for power plant engineering—construction

Fluor is one of the nation's major contractors with an excellent engineering and construction record for the power industry. With access to four engineering offices located at Los Angeles, Houston, New York City and Niagara Falls, Ontario, plus two manufacturing plants and construction depots (Los Angeles and Paola, Kansas), Fluor has a large reservoir of talent, facilities and equipment at its disposal.

Fluor not only provides design, engineering, purchasing and construction under a single responsibility, *but guarantees the price.* Fluor is a large, closely-integrated organization and is in a position to write any type of contract desired, doing business on *your* basis. Generally these contracts fall into one of these three broad classifications:

LUMP SUM OR "TURNKEY"

In this contract, Fluor assumes complete responsibility for all details from design to initial plant operation. Fluor becomes the sole contractor at a firm figure agreed upon in advance. Only by dealing with one reliable firm can the full benefits of a "turnkey" contract be realized. The tremendous time-saving advantages alone result in a lower, overall price with a guaranteed, in-service date.

GUARANTEED MAXIMUM

This contract (also known as "maximum price with a division of savings") is based upon cost plus a fixed fee. The price to the customer cannot be exceeded—it is *guaranteed.* But if savings are effected during the job, they are divided proportionately between the customer and Fluor. The customer never pays more than the agreed price and he may pay less. Under a "Guaranteed Max" contract, it is to the advantage of both parties to get the plant in operation as quickly and as economically as possible.

COST PLUS

On certain projects which cannot be sufficiently defined, the cost plus contract will apply. Under this contract (also called "open end"), the customer reimburses Fluor for all "out-of-pocket" costs during the job, and pays a fee for Fluor's services.

BE SURE WITH **FLUOR**

THE FLUOR CORPORATION, LTD
LOS ANGELES 22, CALIFORNIA
FLUOR OF CANADA - TORONTO
FLUOR PERUANA, S.A. - LIMA
HEAD WRIGHTSON - LONDON

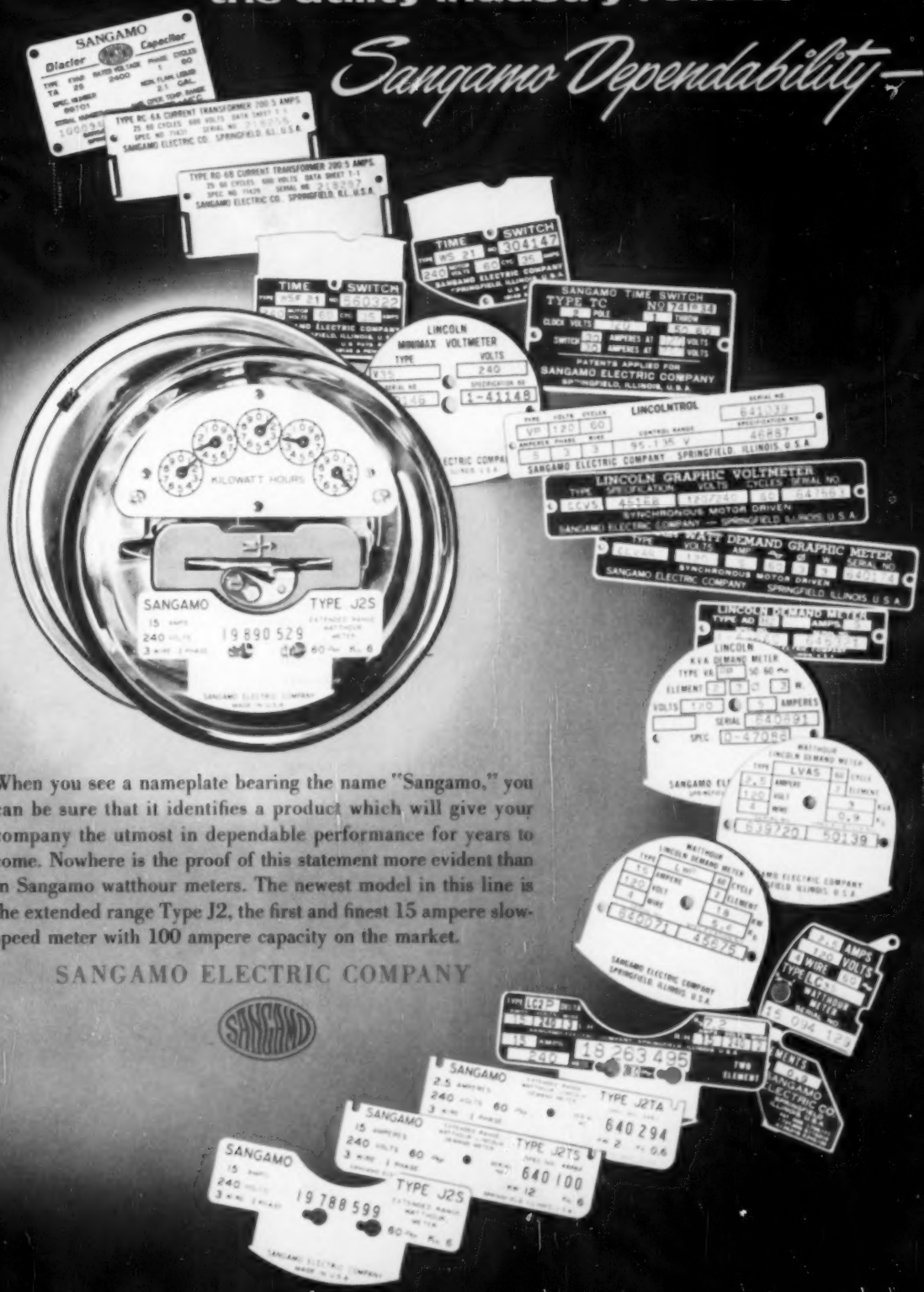
ENGINEERS CONSTRUCTORS MANUFACTURERS

NEW YORK CHICAGO PHILADELPHIA BOSTON PITTSBURGH SAN FRANCISCO HOUSTON BIRMINGHAM TULSA DENVER

Fluor is one of a very few firms who write all of these contracts. Before you build, investigate all three. We welcome your inquiries.

These nameplates on equipment used by the utility industry reflect

Sangamo Dependability—

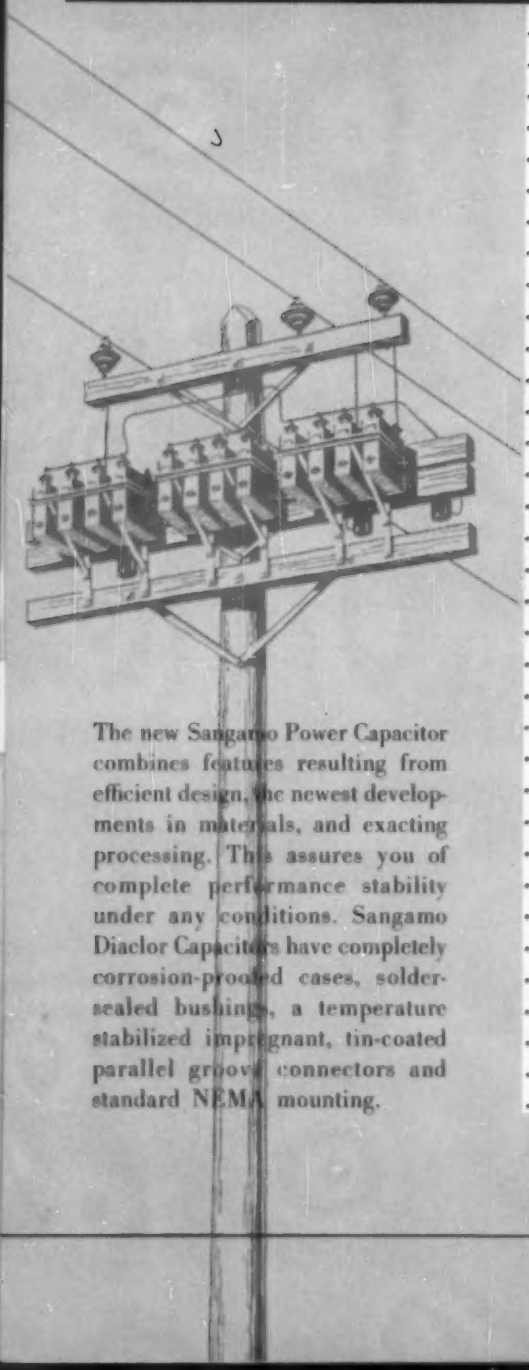


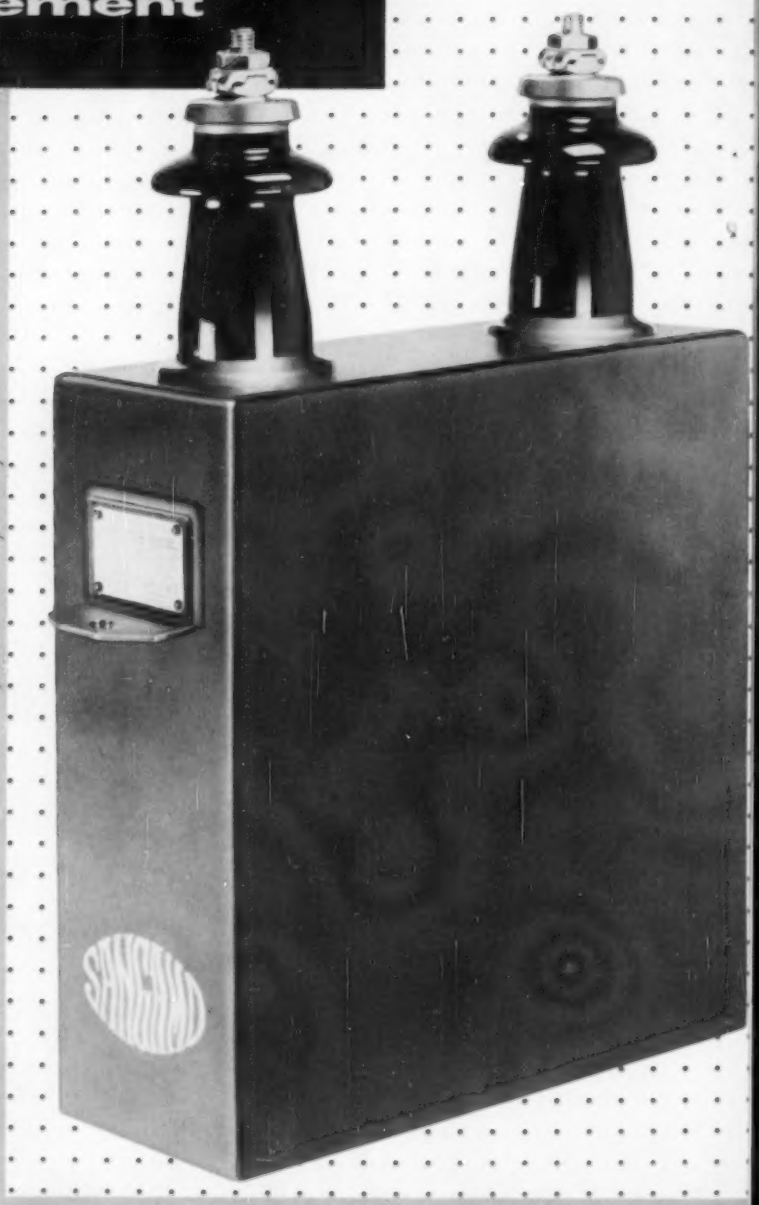
When you see a nameplate bearing the name "Sangamo," you can be sure that it identifies a product which will give your company the utmost in dependable performance for years to come. Nowhere is the proof of this statement more evident than in Sangamo watthour meters. The newest model in this line is the extended range Type J2, the first and finest 15 ampere slow-speed meter with 100 ampere capacity on the market.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD

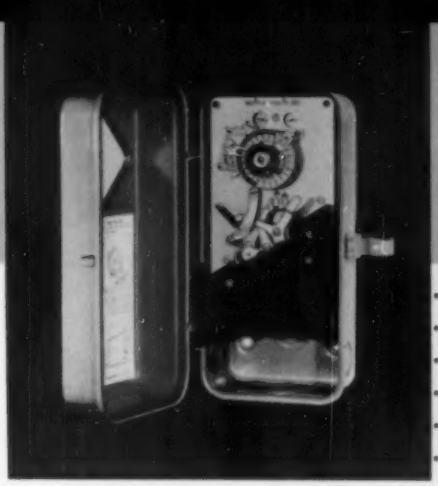
CAPACITORS for Power Factor Improvement



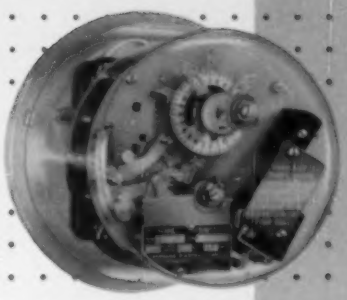


The new Sangamo Power Capacitor combines features resulting from efficient design, the newest developments in materials, and exacting processing. This assures you of complete performance stability under any conditions. Sangamo Diaclor Capacitors have completely corrosion-proofed cases, solder-sealed bushings, a temperature stabilized impregnant, tin-coated parallel grooved connectors and standard NEMA mounting.

SANGAMO



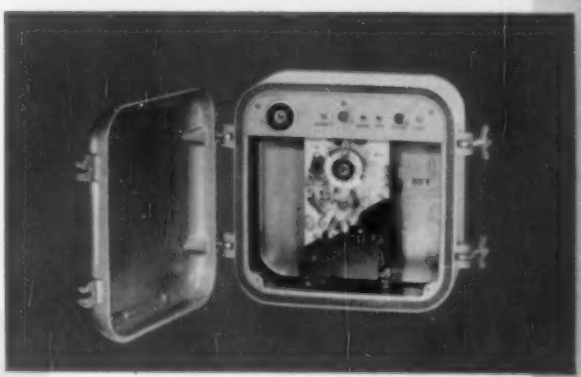
Type W Synchronous-Carryover Time Switch in conventional case



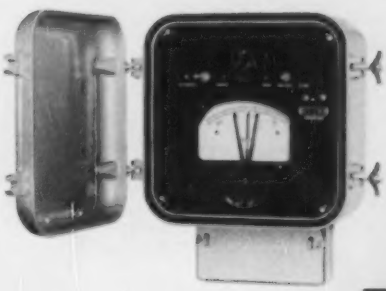
Type WS Synchronous-Carryover Time Switch for socket mounting

Your power capacitors, switched on the basis of time, will keep exact schedules when equipped with these sturdy synchronously operated time switches with automatic carryover.

Lincolntrols will accurately control your capacitor switching as a function of amperes, volts, watts or vars.



Type WSHOX-12X Fuse-Protected Synchronous Carryover Time Switch for socket mounting, with switches for manual and automatic operation



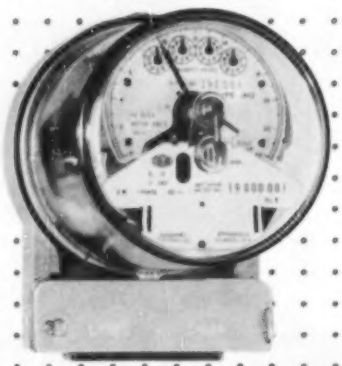
Type VP Lincolntrol. Switches capacitors as a function of voltage. Also available for socket mounting

Capacitor Control Equipment

Meters for Demand Measurement Lincoln Thermal and Mechanical

Type LW2 Polyphase Watthour and Lincoln Thermal Demand Meter

Type J2TS Singlephase Watthour and Lincoln Thermal Demand Meter



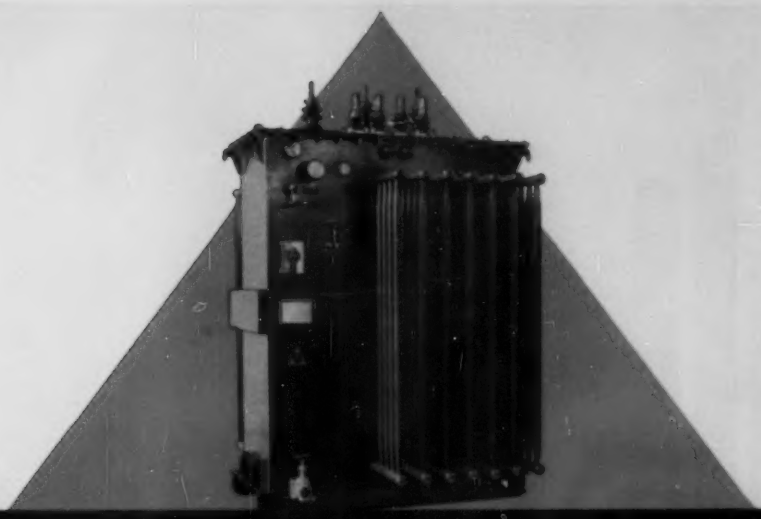
Type J2A Singlephase Watthour Meter with JH2 Mechanical Demand Register

Type LC3S 3-element Polyphase Watthour Meter with LCH2 Mechanical Demand Register

SANGAMO

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS



UPTEGRAFF POWER TRANSFORMERS

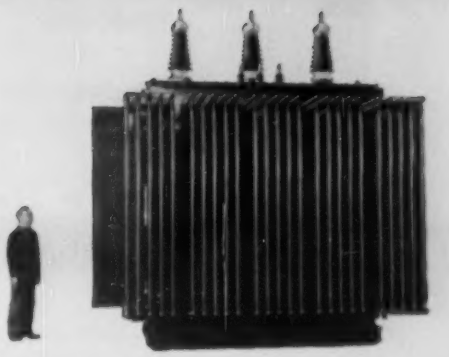
PROMPT DELIVERY... FULLY GUARANTEED

A complete engineering department and a modern, fully-equipped plant give Uptegraff the facilities it takes to provide fast service on power transformer production—even those of special design.

Available in sizes up to 10,000 KVA, 115 KV, every Uptegraff transformer meets or exceeds ASA, NEMA and AIEE standards and is fully guaranteed by our company.

These two advantages are yours when you order Uptegraff transformers for your power needs. And when the unit is delivered and installed, you have one of the finest built pieces of electrical equipment in the country—rugged, leakproof, undercoated, and performance tested.

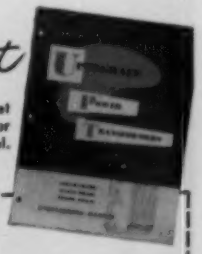
You can order Uptegraff Power Transformers with standard accessories; terminal arrangement, cooling fans, wheels, oversize bushings and many other special accessories are optional.



If you're getting ready to replace or add to your transformer installations, Uptegraff can serve you well and quickly.

Send for Data Booklet

Use coupon below or your letterhead and get this comprehensive ENGINEERING MANUAL for executives, engineering and operating personnel.



R. E. Uptegraff Manufacturing Co.
Scottdale, Pennsylvania

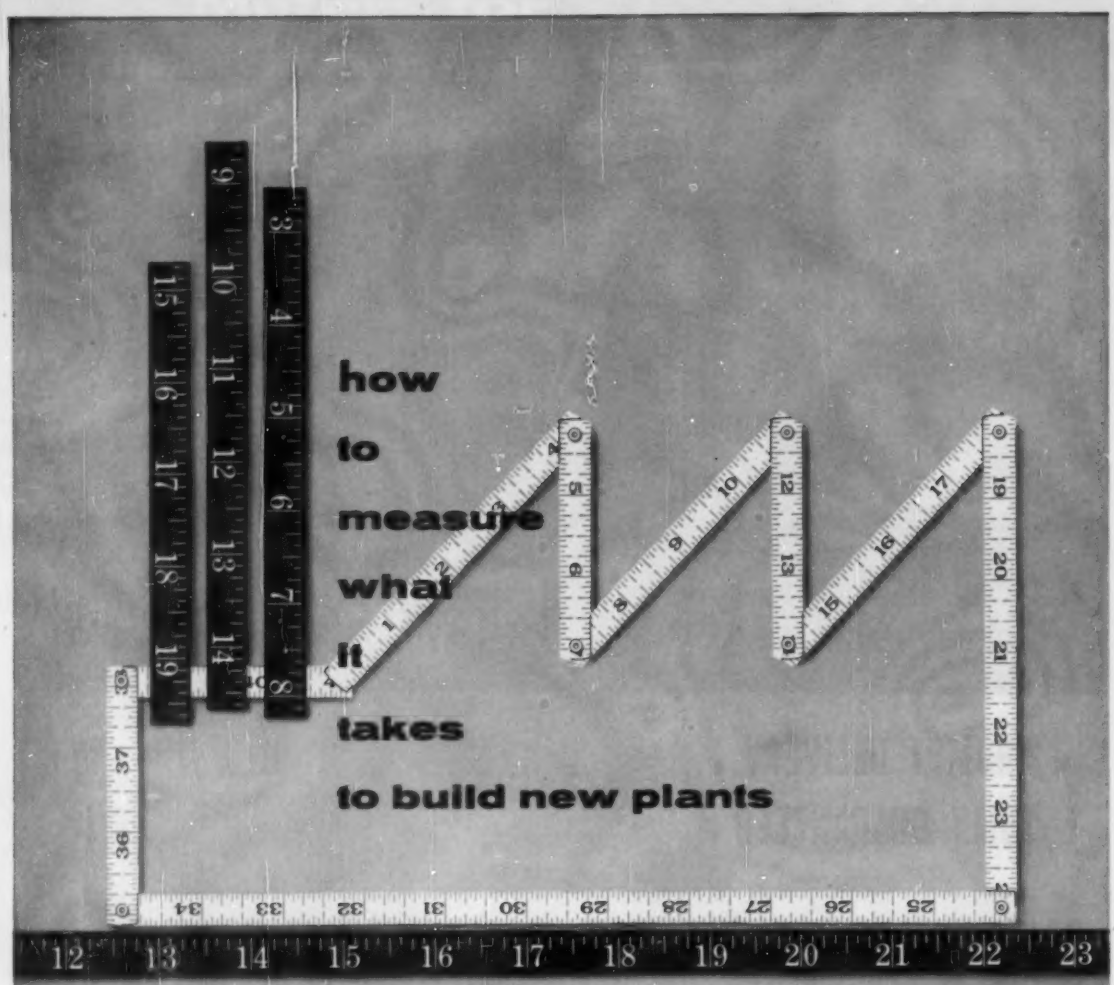
R. E. UPTEGRAFF MANUFACTURING CO.
Scottdale, Pa.

Name_____

Address_____

City_____ State_____

EW



Most ingredients that go into a new plant can be measured by feet or yards, pounds or tons. But there are other things—far more important—that physical yardsticks can't size up.

Experience, for example. Ebasco experience spans half a century, and includes the engineering and construction of more than two billion dollars of plants in the United States and abroad.

Skill and integrity are evidenced in each phase of an Ebasco project. Ebasco's highly qualified technical skill is utilized in every part of the work—from site selection and preliminary planning, through finished construction, to successful operation.

Together these unseen elements add up to *quality* construction, the common denominator of every plant built by Ebasco.

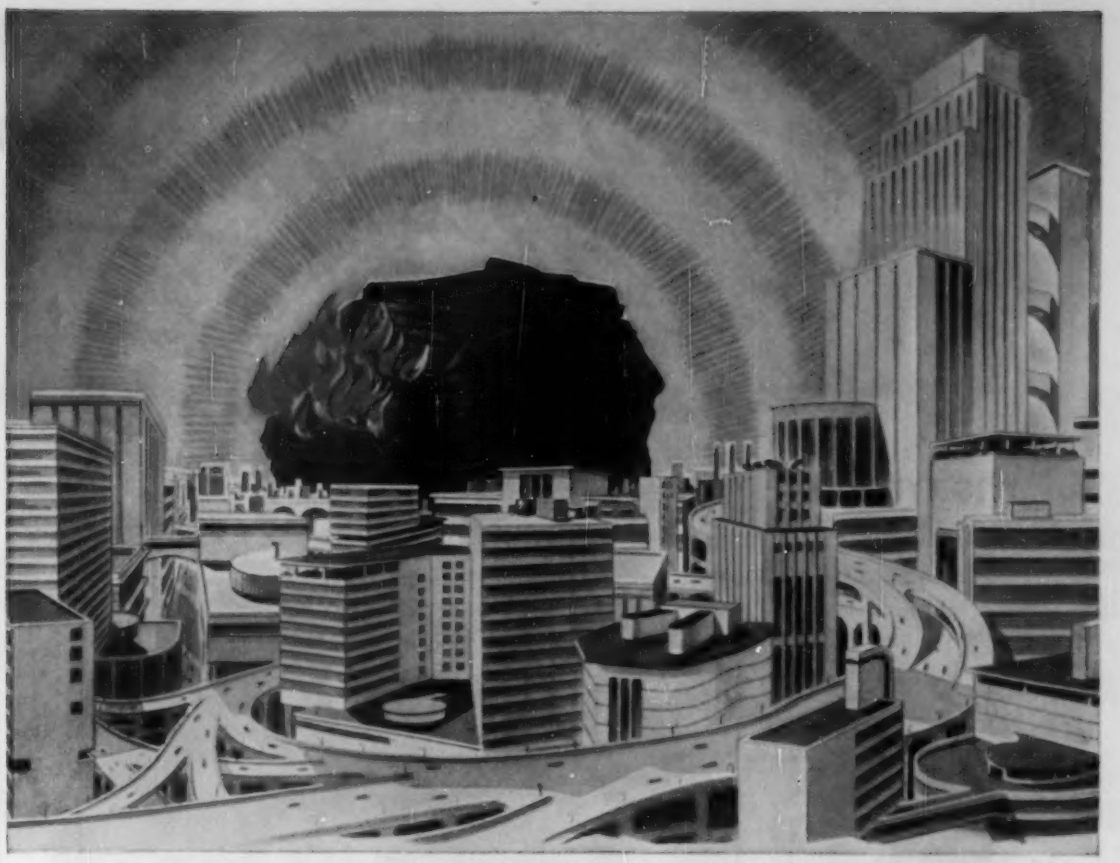
If you are considering a new plant, write for our booklet, "The Inside Story of Outside Help". Address: Ebasco Services Incorporated, Two Rector Street, New York 6, New York.

EBASCO
ENGINEERS · CONSTRUCTORS
BUSINESS CONSULTANTS

NEW YORK · CHICAGO · DALLAS
PORTLAND, ORE. · WASHINGTON, D. C.

Ebasco Services gets things done anywhere in the world

Appraisal · Consulting Engineering · Design & Construction · Financial & Business Studies · Industrial Relations · Insurance, Pensions & Safety
Purchasing, Inspection & Expediting · Rates & Pricing · Research · Sales & Public Relations · Space Planning · Systems, Methods & Budgets · Tax · Washington Office



The fuel that sparked our nation's growth secures her greater future

A young America—primed by a new and power-packed fuel—became a great industrial giant almost overnight. Coal had supplied the first unwavering spark which was to grow into the brightest productive flame the world has ever known.

After being served so well in the past and present, America looks again to dynamic coal for greater prosperity and security in the future. The vast Bituminous fields along the Baltimore & Ohio contain excellent coals in wide variety—available for centuries to come.

Highly mechanized mines, equipped and ready for any demands, will help maintain long-range cost stability. And improved utilization methods will meet the increased requirements of the future by providing greater coal-burning efficiency.

CALL ON OUR COAL TECHNICAL SERVICE

You'll receive complete information from trained B&O experts about the kind and size of Bituminous coal that fits your needs best—at a price you want to pay. Write:

COAL TRAFFIC DEPARTMENT
BALTIMORE & OHIO RAILROAD
BALTIMORE 1, MARYLAND

BITUMINOUS COALS FOR EVERY PURPOSE

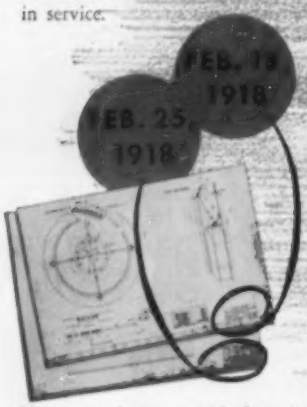
Baltimore & Ohio Railroad

Constantly *doing things* **— better !**

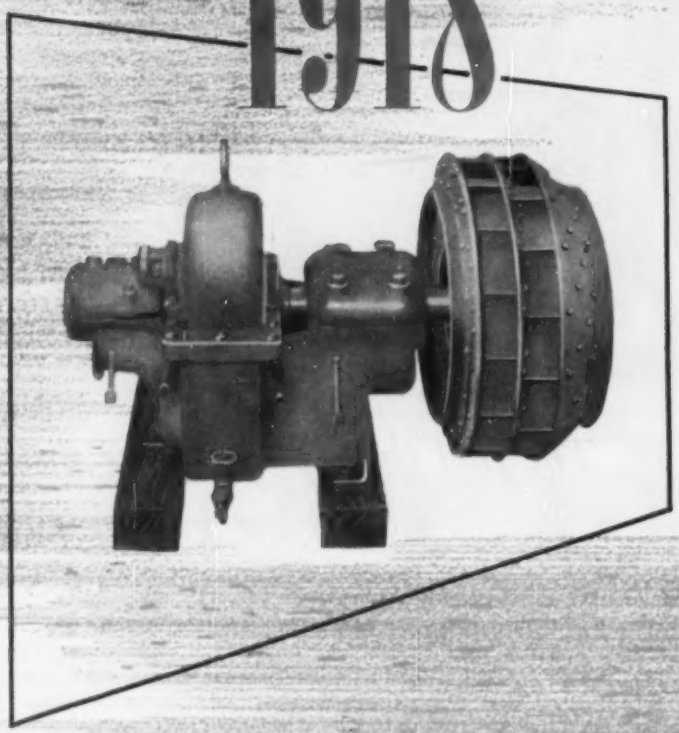
Announcing 1918

1918 TYPE OF GREEN AIRFOIL FANS

Typical of the scores of AIRFOIL Type Fans we designed, manufactured, and shipped some 35 years ago. Some of these units are still in service.



These two drawings with dates in the World War I era show details of the Green AIRFOIL Type Fans as designed and manufactured by us in those days.



We use the word re-opening' purposely for in 1918 at our factory in Beacon and for a few years thereafter we designed, manufactured and shipped many AIRFOIL Type Fans. *The AIRFOIL Type of Fan is not new.* But it has been modernized, refined and improved. Basically, the 1955 fans are not unlike the 1918 units. The blades then and the blades today simulate the design of the airplane wing. Then, as today, this type of blade produces considerably higher mechanical and static efficiencies than other types of blades.

The 1955 Line of Green AIRFOIL Type Draft Fan consists of six (6) different design variations which provide wide latitude in the choice of volume-pressure combination. Conservatively rated—as has always been a Green policy—these fans show exceptionally high static and mechanical operating efficiency.

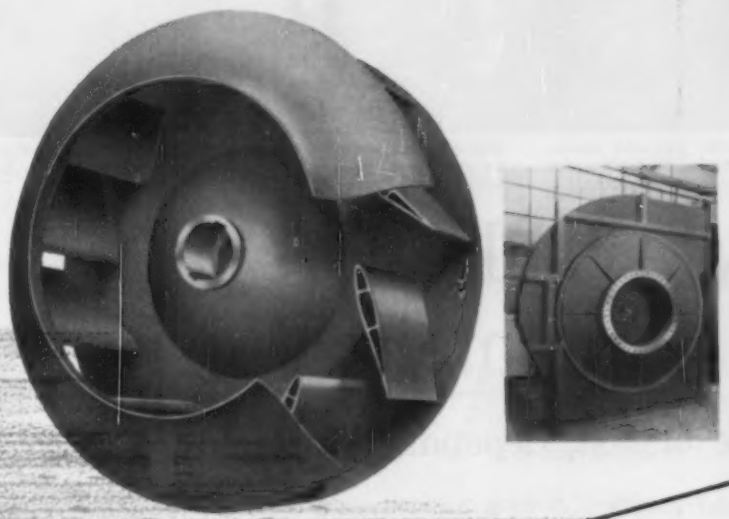
We are designating our line of AIRFOIL Fans as the GALEX Fans. They really deliver gales of air.

Complete details of the Green AIRFOIL Fans will be sent on request. Our engineers will be glad to discuss your fan requirements if you have any specific questions.

THE RE-OPENING OF THE LINE OF GREEN AIRFOIL TYPE FANS

1955 VERSIONS OF 1918 DESIGNS

1955



1955 VERSION OF AN AIRFOIL TYPE FAN

GREEN THE AIRFOIL TYPE FAN Galex FAN

GREEN
POWER AND PROCESS PLANT EQUIPMENT

FUEL ECONOMIZER COMPANY
BEACON 3, NEW YORK

The Ansul dry chemical fire equipment pictured above includes portable hand units, wheeled and stationary units and a jeep installation. Ansul also manufactures automatic dry chemical piped systems, custom engineered for the hazard. Ansul equipment is listed and approved by Underwriters' and Factory Mutual Laboratories.

Only Ansul offers a Five Year Equipment Warranty

Your assurance of fast, dependable fire protection

For you, the buyer of fire equipment, Ansul's important 5 year warranty means many extra years of fast, dependable protection. It also means freedom from costly maintenance checks and repairs.

Special design and construction features make this warranty possible. Ansul's *weather-tight* construction keeps out moisture, resists corrosion. *Patented nozzles* deliver the right kind of stream for your hazard. A *sealed pressure cartridge* puts Ansul's "Plus Fifty" dry chemical to work immediately—no delay or lag. Finally, *rugged construction* makes it possible for Ansul equipment to give peak performance under the toughest operating conditions.

Call the Ansul Man!

Get in touch with your local Ansul man through the "yellow pages" or write ANSUL CHEMICAL COMPANY, Fire Equipment Division, Dept. F-153 Marinette, Wisconsin. *Write Ansul for your copy of new Fire Equipment Catalog.*

ANSUL

IMPORTANT INSURANCE FOR HEAVY EXTRUSION USERS:

Our two new 8,000-ton presses will be identical!

In September Kaiser Aluminum will have a new 8,000-ton heavy extrusion press in operation at Halethorpe, Maryland, as part of the Air Force heavy press program.

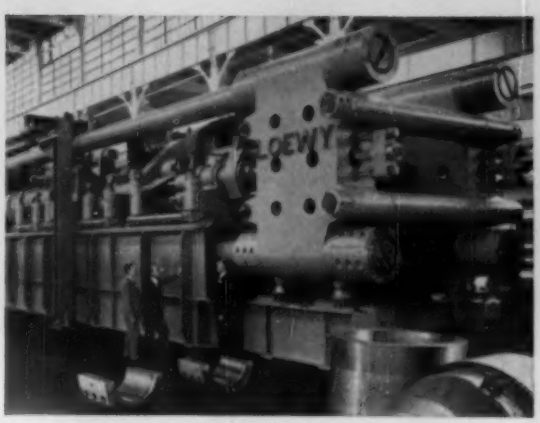
Soon after this press begins operating, our *second* press—of exactly the same size and capacity—will go into production.

Because the presses are identical, dies may be moved from one press to the other without modification or delay.

As a result, regardless of any temporary shutdown of either of the two presses, production can continue without interruption. Air frame manufacturers and other users of heavy extrusions are thus insured against delays and disrupted schedules.

Company engineers should prepare designs promptly in order to overcome the required lead-time and benefit from the presses' early operations.

Kaiser Aluminum engineers with long experience in extrusions are available to work with you on your designs. If you would like to see how heavy aluminum extrusions fit into your production, you are urged to take immediate advantage of this service.



Contact Kaiser Aluminum & Chemical Sales, Inc. General Sales Office, Palmolive Bldg., Chicago 11, Illinois; Executive Office, Kaiser Bldg., Oakland 12, Calif.

Kaiser Aluminum

setting the pace—in growth, quality and service

IMPORTANT FACTS ABOUT THE KAISER ALUMINUM HEAVY PRESS PROGRAM:

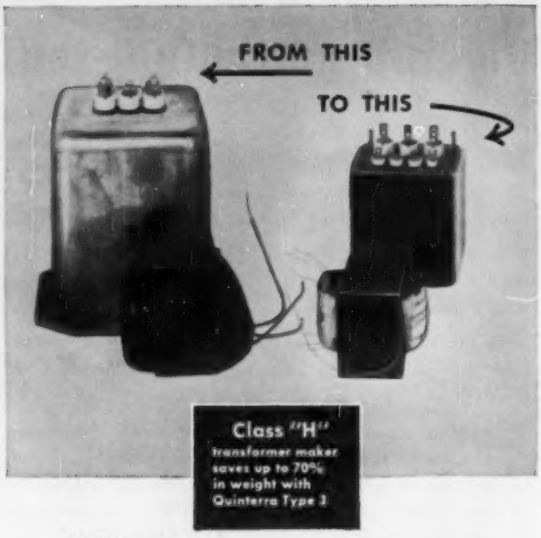
1. Maximum billet size will be 20" O.D. x 56" long. Maximum circle size will be 17" in diameter. Maximum weight per piece will be 1,200 lbs. Maximum finished length will be 85 feet.

2. The use of these large extrusions will, in many applications, eliminate the costly production and assembly of several smaller component parts. This means potentially large savings in both money and man-hours to the aircraft, transportation, electrical and other industries.

3. The ingots used on these presses will be made using revolutionary degassing and metal handling techniques developed by Kaiser. Result: a new order of ingot quality; freedom from gas porosity; highest degree of freedom from inclusions; soundest, highest quality extrusions ever made.

4. The new Kaiser Aluminum heavy extrusion plant is completely equipped and fully integrated for the production of heavy extrusions exclusively.

Quinterra BRINGS SUBSTANTIAL SAVINGS to Class "B" and Class "H" transformer makers...



. . . each using a different type Quinterra® to meet his needs

THE two "before and after" photographs above do more than show what manufacturers can do when they employ Quinterra as layer insulation. They also demonstrate that the manufacturer is not limited to one type of this thin, flexible, purified asbestos insulation. Any one of several types will help him conserve materials, gain greater safety, raise overload limits, decrease rejects, lessen production costs, and lengthen service life.

For Class "B" operations, he can choose Type 5-2 ply . . . the twin-ply Quinterra treated with polyvinyl acetate. It retains its dielectric strength of about 300 VPM at temperatures above the Class "B" maximum of 130 C. Strongest of the Quinterras, it is made by combining and calendering two layers together into a dense, smooth-surfaced sheet. Its excellent tensile and bursting strengths enable assemblers to reach favorable production rates. And it also provides a large square foot per dollar coverage.

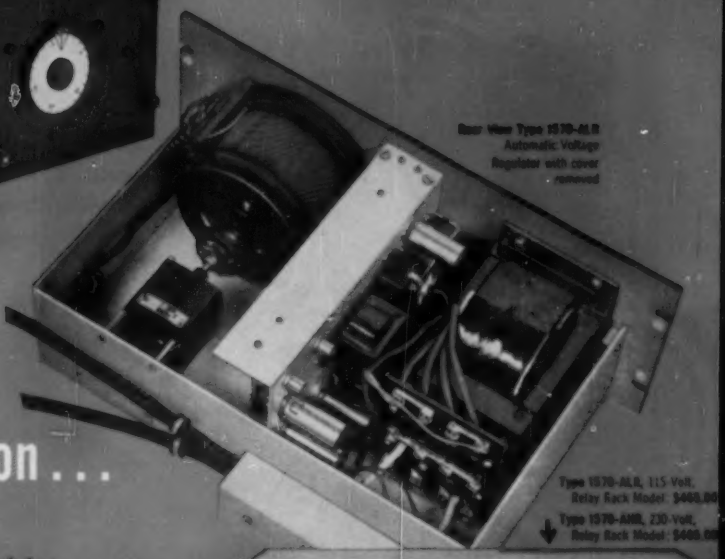
For Class "H" operations or for high processing and ambient temperatures, the manufacturer can choose single-ply silicone-treated Quinterra Type 3. Its dielectric strength of about 300 VPM is retained under continuous exposure to temperatures higher than 180 C, the Class "H" maximum. It also has good moisture-resistance, flexibility, and adequate physical strength for many applications.

Each of these Quinterras is made of the same highly purified asbestos base sheet that has the inherent dielectric . . . and has a hole-free, closed structure. They differ only in the saturant used and in the number of plies. Write for Quinterra booklet EL-40A and samples to Johns-Manville, Box 60, New York 16, N. Y. In Canada, address 565 Lakeshore Rd. East, Port Credit, Ont.

JOHNS MANVILLE PRODUCTS

Johns-Manville ELECTRICAL INSULATIONS

Type 1570-ALR, 115-Volt, Table Top Model: $465.00
Type 1570-AHR, 230-Volt, Table Top Model: $465.00



Rear View Type 1570-ALR Automatic Voltage Regulator with cover removed

for Really *ACCURATE* *Automatic* Line-Voltage Regulation . . .

GR Type 1570-A Automatic Line-Voltage Regulator

Type 1570-ALR, 115-Volt, Relay Rack Model: $465.00
Type 1570-AHR, 230-Volt, Relay Rack Model: $465.00

- ★ Voltage Held Constant to ±0.25%
- ★ High Response Speed: 10 Volts Per Second
- ★ Output Voltage Adjustable to ±10% of Input
- ★ No Waveform Distortion
- ★ No Power Factor Restrictions
- ★ High Capacity: 50 Amperes (6 KVA)
- ★ High Efficiency: 98%
- ★ No Relays — No Transient Pulses — No Chattering

The G-R Type 1570-A Automatic Line-Voltage Regulator basically consists of a ball-bearing VARIAC autotransformer that adjusts the output voltage, a 'buck-or-boost' step-down transformer that effectively multiplies the power rating of the VARIAC, and a servomechanism system that positions the VARIAC.

Most automatic voltage regulators use vacuum tubes, saturable core devices or mechanical systems as the regulating elements. The new G-R Regulator avoids all of the disadvantages inherent in any of these systems.

This regulator is available in three models for both 115- and 230-volt lines. It is proving very valuable both in the laboratory and in industrial operations where automatic voltage regulation is necessary.

Type 1570-ALW, 115-Volt, Wall Model: $465.00
Type 1570-AHW, 230-Volt, Wall Model: $465.00

Write for the G-R Voltage Regulator Bulletin

INPUT VOLTAGE RANGE

Output Voltage	Nominal Adjustable ±10% 115 Volts		230 Volts	
Input voltage as a percentage of output voltage*	90% to 110%	80% to 120%	90% to 110%	80% to 120%
Output current amperes	50	25	20	10
KVA	6	3	5	2.5
Accuracy in % of output voltage	0.25%	0.5%	0.25%	0.5%
Speed of Response volts per second	10	20	20	40

*Types 1570-AL and 1570-AH can be connected for either ±10% or ±20% input voltage range. Instruments are shipped connected for ±10% range unless 20% range is specified on order.

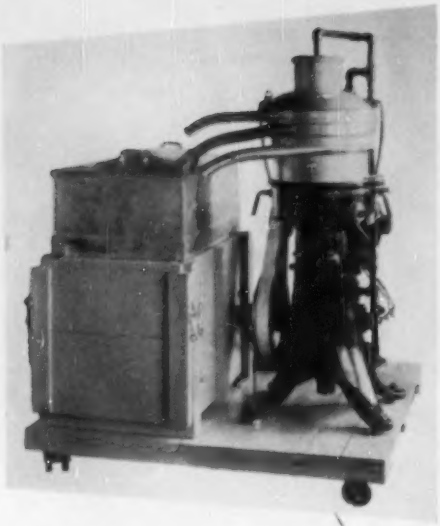
WE SELL DIRECT
Prices are net, FOB Cambridge or West Concord, Mass.

GENERAL RADIO Company

275 Massachusetts Avenue, Cambridge 39, Massachusetts, U. S. A.

90 West Street NEW YORK 6
9956 13th St., Silver Spring, Md. WASHINGTON, D. C.
York Road & Guernsey Avenue, Abington, Pa. PHILADELPHIA
920 S. Michigan Ave. CHICAGO 5
1000 N. Seward St. LOS ANGELES 38

GR 1915-1955 40 Years of Pioneering in Electronics



FIRST!...

This was the first centrifugal purifier for insulating oil used anywhere in the world. Time was 1921; place, Public Service Company of New Jersey plants; maker, De Laval.

...STILL FIRST!

Today—35 years later—De Laval Insulating Oil Purifiers are still the most efficient, trustworthy and economical method of maintaining high dielectric strength. That's why they are used by the majority of important power companies in the country.

De Laval Bulletin TR gives complete information. ***Write for it***...today!

DE LAVAL
insulating oil purifiers

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • **DE LAVAL PACIFIC CO.** 61 Beale St., San Francisco 5

taps and splices

copper
ACSR
aluminum
steel and
copperweld

NOW...

BURNDY PUTS 12 TONS IN YOUR HANDS

Y35 HYPRESS

all **BURNDY** compression connectors for overhead lines may be installed with the Y35 HYPRESS including

- CRIMPITS
- HYSPLICES
- DEADENDS
- ELTAPS
- LINKITS
- BYTAPS
- T-TAPS

SIMPLIFIED DIE INSERTION — Identical interchangeable head and ram dies easily inserted and locked in position so that HYPRESS can be moved along connector without movement of dies.

QUICK RAM ADVANCE — Clockwise rotation of handle (A) moves die up to grip connector (B). Installation is completed by pumping until built-in overload valve clicks open. Trigger returns die to pre-set position.

Burndy developed and produced the first portable hydraulic HYPRESS in 1938. Experience and field usage since that time has made these features possible:

- Lightweight — weighs only 12 pounds
- Head Rotatable 180°
- Neoprene Insulated Body and Handles
- Crimping Die Release Trigger on Handle
- Sealed Hydraulic System

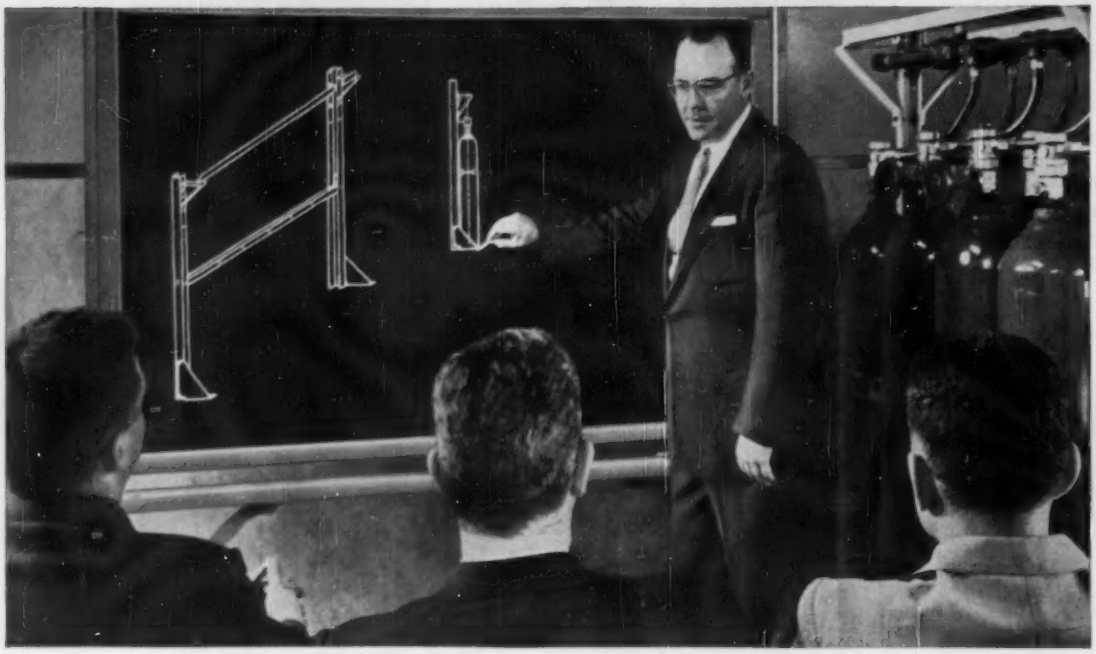
For further details or demonstration, contact your Burndy representative or write Burndy, Norwalk, Connect. — Toronto, Ontario for instruction manual.

BURNDY

E5-6

It's good business to connect with Burndy ... FIRST name in electrical connectors; tools; methods

GREATEST FIRE FIGHTING DESIGN ADVANCE IN 25 YEARS!



This Kidde Automatic Pressure-Operated CO_2 Extinguishing System is *brand new from the floor up!*

✓ CHECK THESE 9 FEATURES!

☐ **1.** NO FALLING WEIGHTS – No clumsy mechanical triggering methods. Pneumatic or Electrical Control Heads automatically trigger CO_2 cylinders, assure complete discharge!

☐ **2.** SELF-ENCLOSED PARTS – All moving parts of the new Kidde system are self-enclosed to prevent fouling or accidental operation!

☐ **3.** EASIER INSTALLATION – New racking arrangement is pre-drilled at the factory, eliminates need for special hangers, tools or outside material! Can be either "free standing" or wall mount.

☐ **4.** NO PARTS TO REPLACE – Even after a fire, operating parts of the new Kidde system can be re-set with a screwdriver. No parts need be replaced. Refill cylinders and system is ready for operation!

☐ **5.** SIMPLE, THOROUGH TESTING – By merely disconnecting control heads from cylinders, *all* operating parts (other than actual discharge of CO_2 gas) can be tested *in place!*

☐ **6.** QUICK VISUAL INSPECTION – All primary actuating parts fitted with easy-to-read visual indicator. Shows at a glance if system is "set" or "released."

☐ **7.** MULTIPLE PROTECTION – Automatically-operated Directional Valves let you protect more than one hazard from the same bank of cylinders!

☐ **8.** SIMPLIFIED WEIGHING – New racking arrangements lets you weigh CO_2 cylinders right in place without disconnecting them, providing uninterrupted fire protection even while cylinders are being weighed!

☐ **9.** AUXILIARY EQUIPMENT – Also available for use with the new Kidde system are devices for turning power on or off, for opening or closing doors, windows, dampers, etc.

The Kidde Automatic CO_2 Extinguishing System is not just an improved model – it is a system completely new in every detail! The result of more than 25 years' design experience, the Kidde system is available either electrically-operated or pressure-operated.

Fully approved by Underwriters' and Factory Mutual Laboratories. Complete details of this revolutionary new system are contained in Kidde's Pressure-Operated System Booklet. Write for your copy today!

Kidde (K Kidde)

The words 'Kidde', 'Lux', 'Lux-O-Matic', 'Fyre-Freaz' and the Kidde seal are trademarks of Walter Kidde & Company, Inc.

Walter Kidde & Company, Inc., 730 Main Street, Belleville 9, N. J. • Walter Kidde & Company of Canada, Ltd., Montreal—Toronto

ROECLAD PORTABLE POWER CABLES

TYPE G ROECLAD CABLE – with ground wires – for service to 5000 volts.

TYPE W ROECLAD CABLE – without ground wires – for service to 2500 volts.

TYPE SH-A, B, C or D ROECLAD CABLE – shielded, with or without ground wires – for voltages above 2500 – made in four different applications of shielding and ground wires.

YOU WANT

- RUGGEDNESS – FOR MAXIMUM LIFE IN TRANSMITTING POWER TO MOBILE EQUIPMENT UNDER TOUGHEST CONDITIONS;
- CABLES THAT ARE TAILOR-MADE FOR YOUR OWN PARTICULAR REQUIREMENTS;

IN SHORT,

YOU WANT

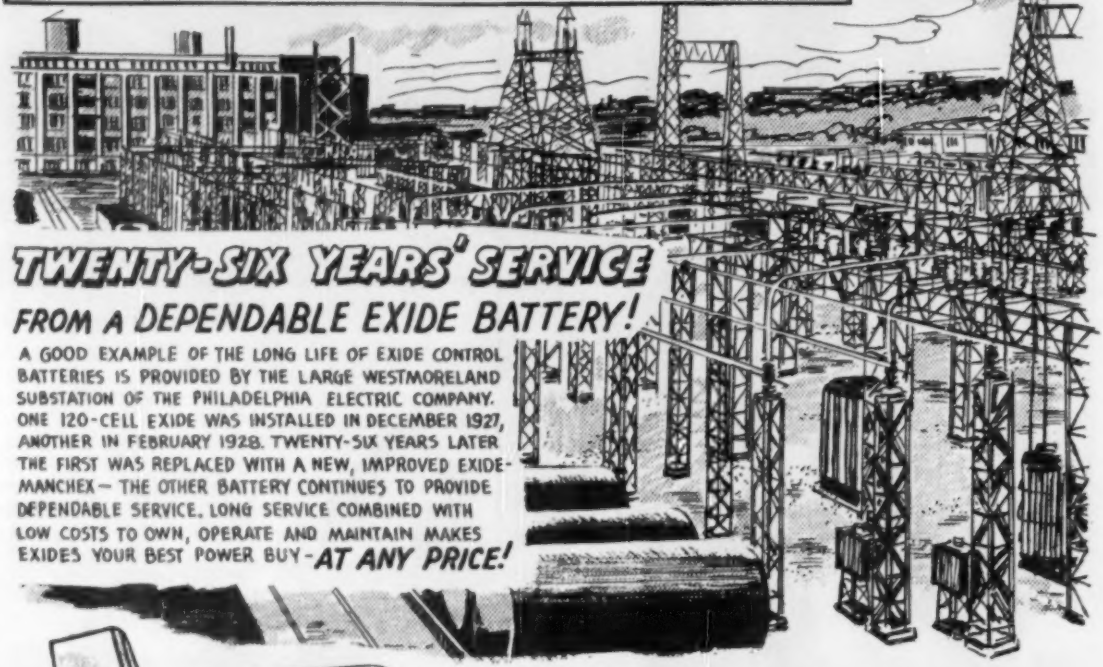
ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13235 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, TRENTON 2, N. J.

FACTS ABOUT Exide®

MANCHEX® SWITCHGEAR AND CONTROL BATTERIES



TWENTY-SIX YEARS' SERVICE FROM A DEPENDABLE EXIDE BATTERY!

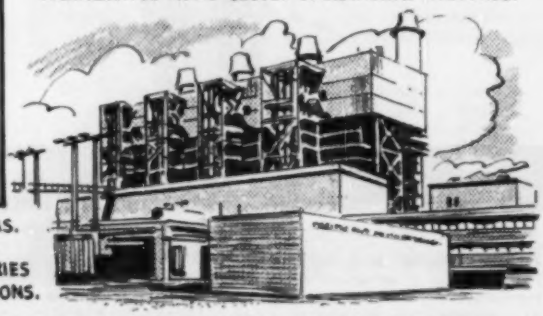
A GOOD EXAMPLE OF THE LONG LIFE OF EXIDE CONTROL BATTERIES IS PROVIDED BY THE LARGE WESTMORELAND SUBSTATION OF THE PHILADELPHIA ELECTRIC COMPANY. ONE 120-CELL EXIDE WAS INSTALLED IN DECEMBER 1927, ANOTHER IN FEBRUARY 1928. TWENTY-SIX YEARS LATER THE FIRST WAS REPLACED WITH A NEW, IMPROVED EXIDE-MANCHEX — THE OTHER BATTERY CONTINUES TO PROVIDE DEPENDABLE SERVICE. LONG SERVICE COMBINED WITH LOW COSTS TO OWN, OPERATE AND MAINTAIN MAKES EXIDES YOUR BEST POWER BUY - *AT ANY PRICE!*

INSIDE AN EXIDE-MANCHEX *THE SECRET OF LONG LIFE... DEPENDABLE POWER!*

THE EXCLUSIVE MANCHESTER POSITIVE PLATES ARE THE HEART OF THE MANCHEX BATTERY... THE SOURCE OF POWER. LEAD BUTTONS ARE PRESSED INTO HOLES OF THE GRID. ONLY A SMALL PORTION OF THE TOTAL LEAD IS FORMED INITIALLY INTO ACTIVE MATERIAL. THE REMAINDER IS AVAILABLE FOR GRADUAL CONVERSION DURING YEARS OF SERVICE. YOU GET LONGER LIFE... MORE DEPENDABLE POWER IN LESS SPACE!

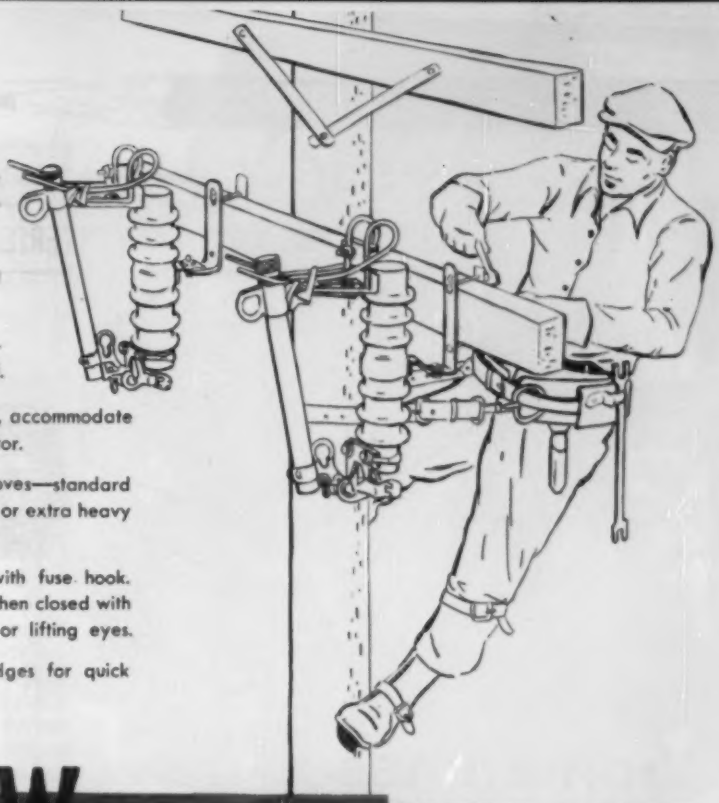
POSITIVE OPERATION OF SWITCHGEAR ASSURED BY EXIDE-MANCHEX BATTERIES IN THE WEST'S LARGEST STEAM PLANT

DEPENDABLE POWER FOR INSTANT OPERATION OF CIRCUIT BREAKERS... ADEQUATE RESERVE POWER FOR ALL OTHER CONTROL CIRCUITS AND EMERGENCY LIGHTING! THAT IS WHAT EXIDE-MANCHEX BATTERIES FURNISH AT PACIFIC GAS AND ELECTRIC'S ULTRA-MODERN, MAMMOTH PITTSBURG, CALIF., STEAM ELECTRIC PLANT. UTILITIES ALL OVER THE COUNTRY DEPEND ON EXIDES FOR AMPLE STANDBY VOLTAGE... TO AVOID COSTLY OPERATIONAL FAILURES.



LET EXIDE HELP SOLVE YOUR SWITCHGEAR BATTERY PROBLEMS.
1. CALL AN EXIDE SALES ENGINEER FOR FULL DETAILS.
2. WRITE FOR BULLETIN 210 - WHICH TELLS HOW BATTERIES ARE MOST EFFICIENTLY USED IN SWITCHGEAR OPERATIONS.

Exide INDUSTRIAL DIVISION, The Electric Storage Battery Company, Philadelphia 2, Pa.



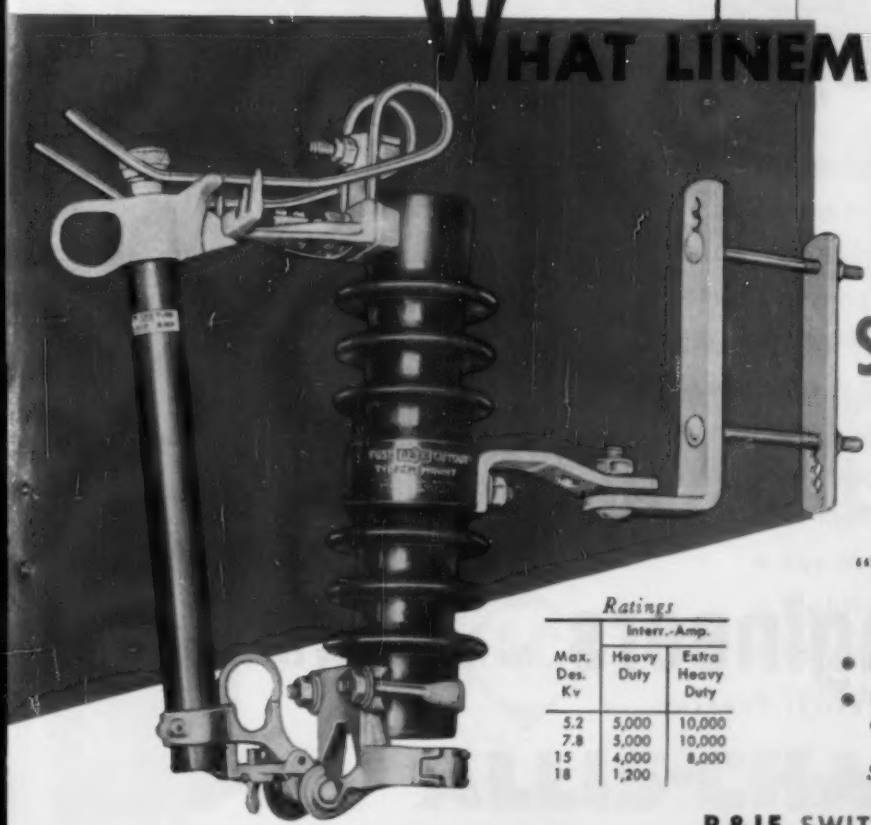
1. Easy to handle—light, compact, no sharp edges. Cartons well identified.
2. Factory assembled mounting bracket—to porcelain.
3. Single nut positioning—vertical, 20 degrees; and swivel.
4. Accessible eye-bolt terminals, accommodate copper or aluminum conductor.
5. Easily re-fused, even with gloves—standard or load break holders, heavy or extra heavy duty interchangeable.
6. Fuseholder easily handled with fuse hook. Will not miss upper contact when closed with fuse hook. Large opening or lifting eyes.
7. Light, compact, no sharp edges for quick handling.

WHAT LINEMEN LIKE

about the

R&IE

Series "C" CUTOUT



Ratings

Max. Des. Kv	Interr.-Amp. Heavy Duty	Interr.-Amp. Extra Heavy Duty
5.2	5,000	10,000
7.8	5,000	10,000
15	4,000	8,000
18	1,200	

"You Get More for Your Money"

- Higher interrupting capacities.
- Heavy duty service at normal duty cost.

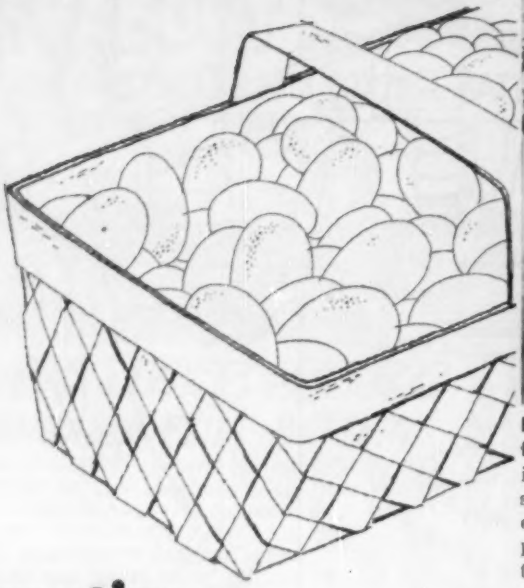
Send for descriptive folder

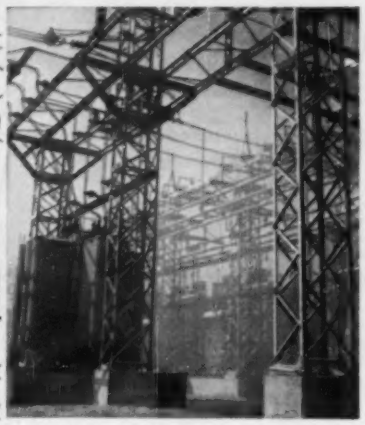
R&IE SWITCHING EQUIPMENT
DIVISION OF I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

STRUCTURES—steel or aluminum • TESTING DEVICES • KIRK KEY INTERLOCK SYSTEMS • ISOLATED PHASE BUS STRUCTURES • INTERRUPTER SWITCHES

INDOOR BUS SUPPORTS and BUS FABRICATION • OUTDOOR BUS SUPPORTS and AIR SWITCHES • SUBSTATION

Capsule Case History:





Enough Power for San Francisco
is generated, distributed and consumed entirely within the 270 acre site of this major primary aluminum plant. Alternating current from steam turbine generators is rectified to direct current before being distributed by this compact and highly efficient system. Dual circuits under centralized control assure a steady supply of power to all points. Aluminum bus is extensively used throughout the plant.

Kaiser Engineers is equipped to design and build your next power system from generator to point of use.

A power brochure (No. 104), outlining the KE experience in generation and distribution, will be mailed to you upon request.

Sometimes it pays...

Kaiser Engineers, a close-knit team of specialists, is staffed to handle every phase of your project. Their work in widely divergent fields of design and construction offers plenty of proof that it pays to put all your project eggs in this one basket.

kaiser engineers ...for low operating costs

DIVISION OF HENRY J. KAISER COMPANY

ENGINEERS K CONTRACTORS

• HOME OFFICE: KAISER BUILDING, OAKLAND 12, CALIFORNIA (CABLE: KAISENGS) NEW YORK, PITTSBURGH, WASHINGTON, D.C.
• HENRY J. KAISER CONSTRUCTION CO. • HENRY J. KAISER COMPANY (Canada) LTD., MONTREAL • KAISER ENGINEERS INTERNATIONAL, INC.

New

Low Voltage

CIRCUIT BREAKERS

- For Motor Loads
- Lighting Loads
- Heaters, Welders
- Transformers

ALLIS-CHALMERS

MILWAUKEE, 1, WISCONSIN

A-4712

Announcing New Accuracy—

Check Outstanding Features of "All-New" Allis-Chalmers Circuit Breakers

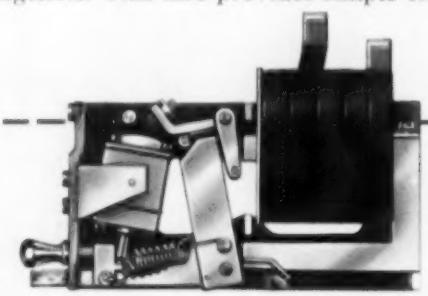
✓ Safe — no exposed current-carrying parts.

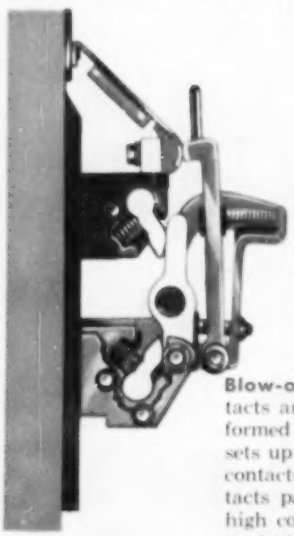
✓ Shows faulted phase — indicator target tells at glance on which phase overload or fault occurred.

✓ Flexible — long-time, short-time and instantaneous trips are available. Each is adjustable independently of the other.

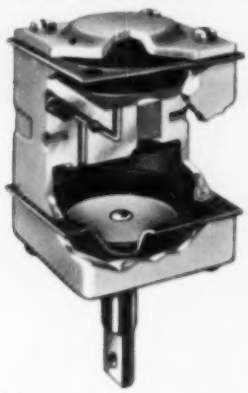
✓ Long contact life — "blow-on" action, plus positive wiping motion, reduces contact erosion.

✓ Interchangeable — trip devices of various ratings are easily interchangeable. This also provides simple change of current ratings.





Positive Displacement Trip Device—Adjustable calibrations on front of trip device permit operator to adjust and set long-time, short-time or instantaneous elements independently. Series trip coils are completely insulated.



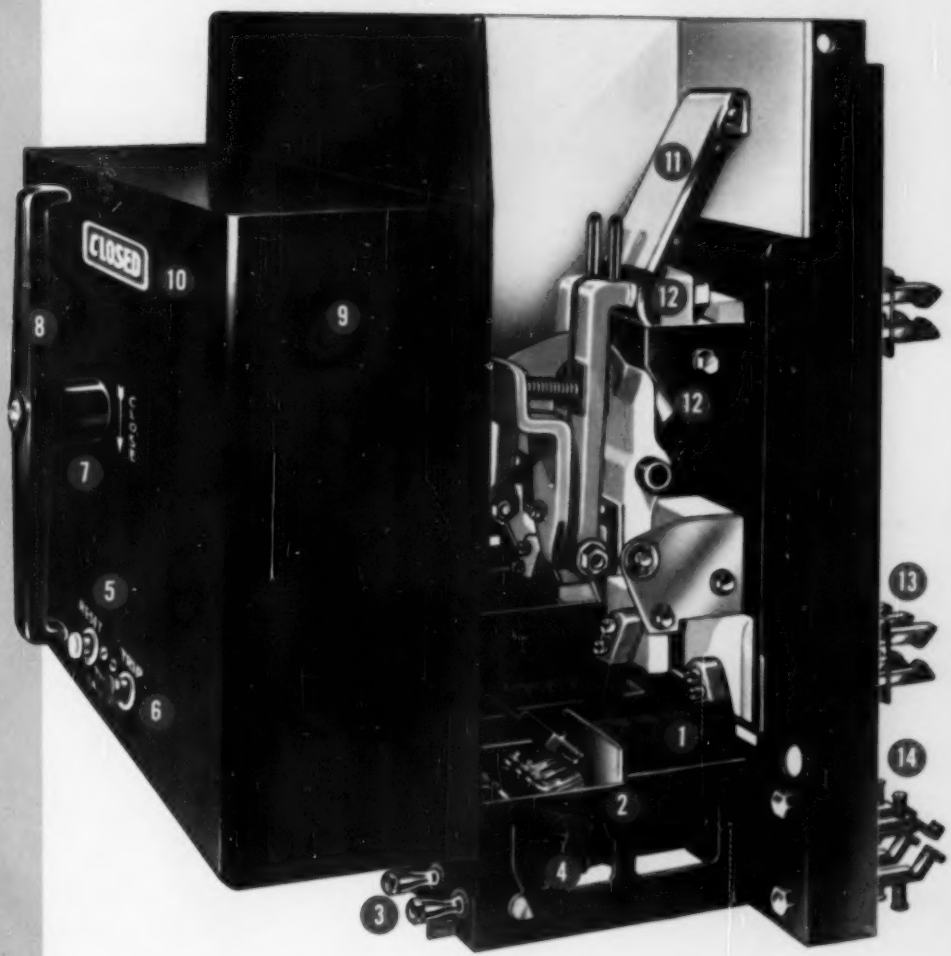
Blow-on Contacts—When contacts are closed, current in loop formed by studs and movable arm sets up magnetic forces pushing contacts together. After main contacts part, blow-on action holds high contact pressure on arcing contacts. On closing, blow-on action helps increase contact pressure — opposes bounce.

Sealed Time-Delay Device
Provides wide range of operating settings . . . assures coordination with other protective equipment. Device is completely calibrated and sealed under vacuum at factory. It requires no maintenance or adjustment.

ALLIS-

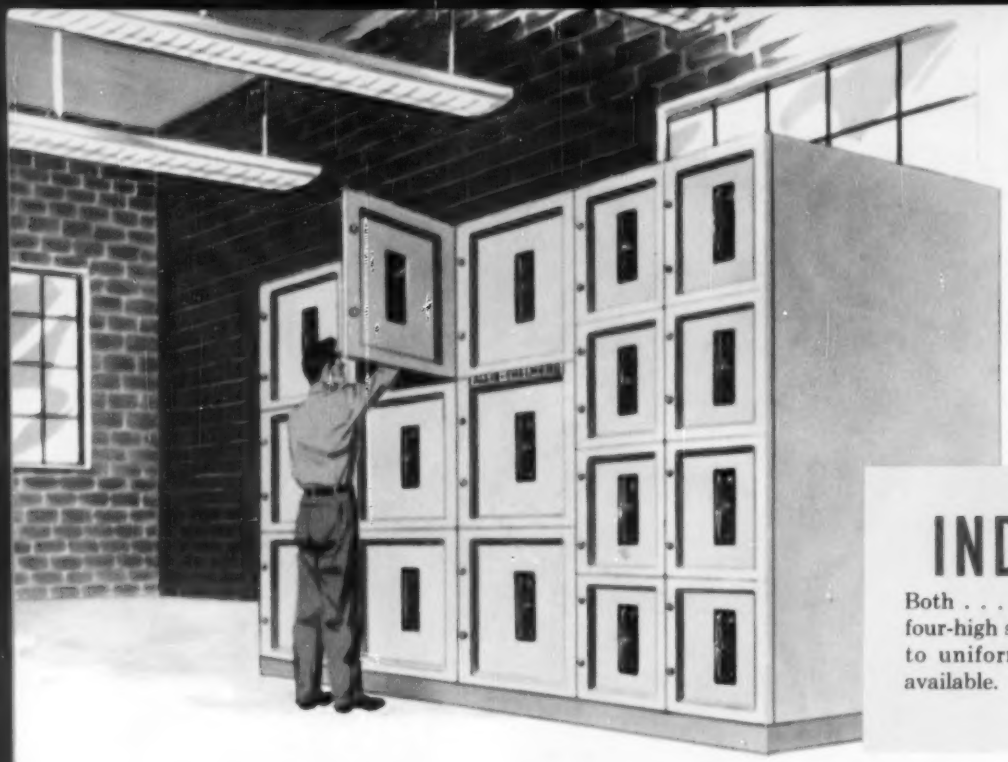
Standards of Safety – Ease of Operation

1 Insulated trip coils
2 Series trip device
3 Trip adjustment knobs
4 Faulted phase target
5 Reset button
6 Trip button
7 Hasp for padlocking
8 T-shaped handle
9 Dead-front shield
10 Position indicator
11 Stainless steel arc runners
12 Blow-on contacts
13 Primary disconnects
14 Secondary disconnects



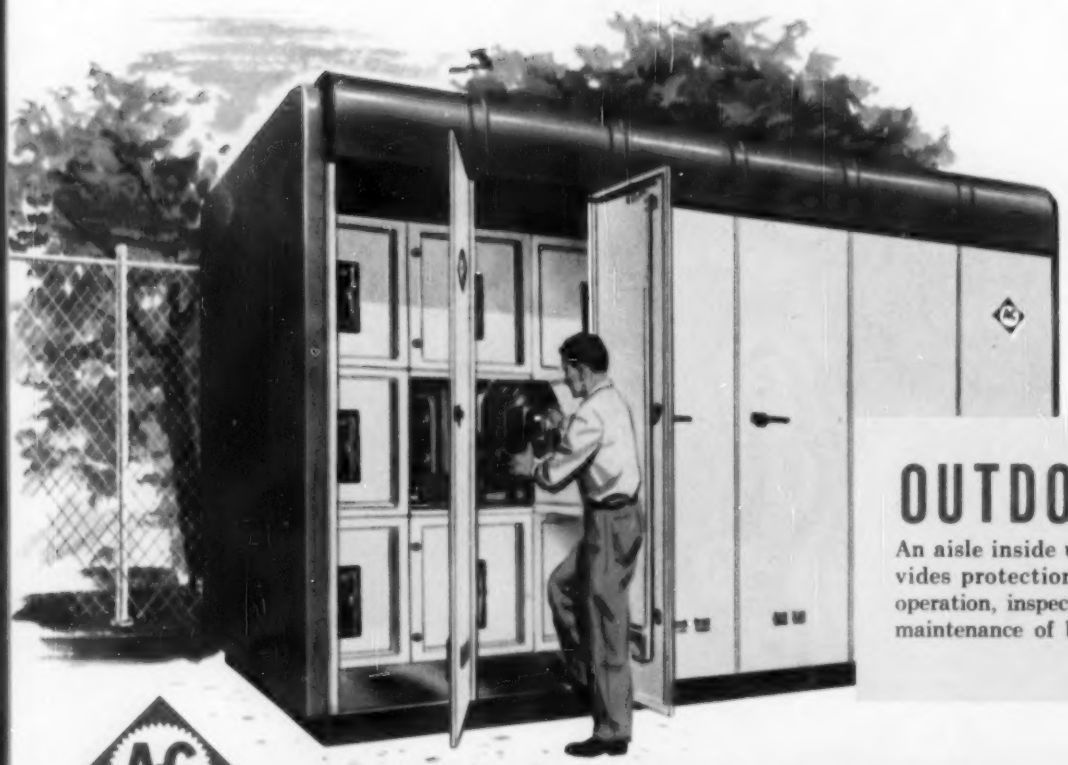
CHALMERS

A-C ALLIS-CHALMERS



INDOOR

Both . . . three-high and four-high structures, built to uniform height, are available.



OUTDOOR

An aisle inside unit provides protection during operation, inspection and maintenance of breakers.

ALLIS-CHALMERS

MILWAUKEE, 1, WISCONSIN

"Glad They Know About Preformed Patch Rods"

All they need to do is wrap a set of Preformed Patch Rods over the damaged conductor. Patch Rods fully restore the tensile strength and conductance of the line.

Linemen know that Patch Rods are easy to install . . . tools are not needed—they simply wrap the rods onto the conductor with a motion similar to "wringing a cloth". Through intimate contact, Preformed Patch Rods become an integral part of the conductor.

Preformed Patch Rods are another example of how PLP progressive ideas are backed by *extensive research* and *sound engineering* to give you the ultimate in *field performance.*

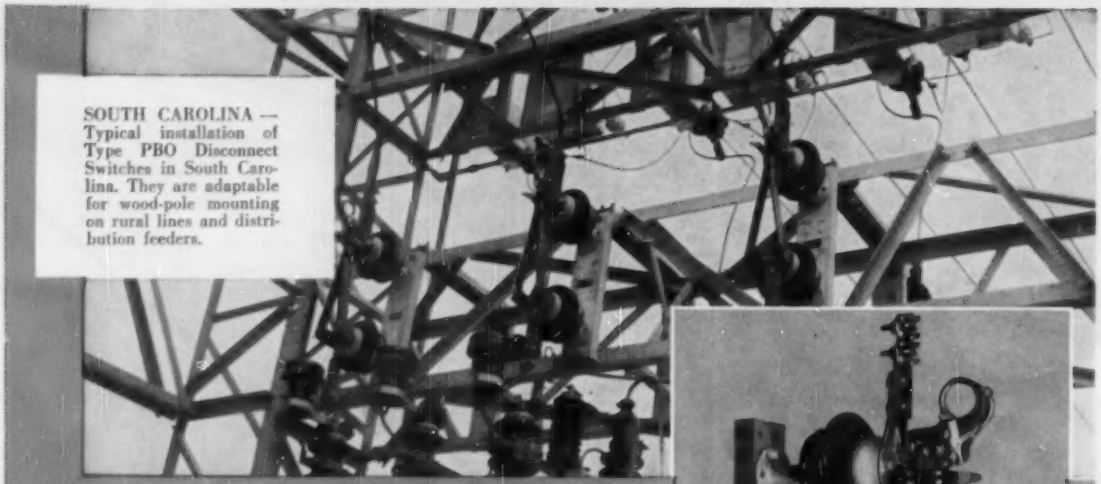
Consult Preformed Line Products or its Representatives for more information on the exclusive advantages of Patch Rods. Write or call Cleveland: EXpress 1-3571.

PREFORMED PATCH RODS

Made in accordance with or for use under one or more of the following U. S. Patents: 2,275,019; 2,587,521; 2,609,653; 2,691,865; other patents pending.

PREFORMED LINE PRODUCTS CO.

5349 ST. CLAIR AVENUE — CLEVELAND 3, OHIO



SOUTH CAROLINA — Typical installation of Type PBO Disconnect Switches in South Carolina. They are adaptable for wood-pole mounting on rural lines and distribution feeders.

WHY LEADING UTILITIES SPECIFY SOUTHERN STATES TYPE PBO DISCONNECTS

Thousands of Southern States Type PBO Disconnect Switches are in use from coast to coast, Canada to Mexico. Here is why they are specified by leading utilities:

HIGH PRESSURE double line contacts. Positive contact assured by wiping action of accurately machined surfaces. Hard drawn copper bus bar blades; double blade construction. 90° open position blade stop unless otherwise specified.

EXTRA LARGE OPERATING RING of heavy duty construction.

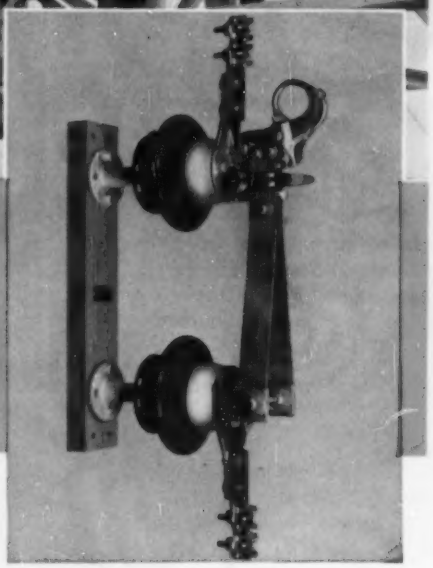
POSITIVE LATCHING of blade in the closed position prevents opening under fault currents or from vibration.

BLADE PRY-OUT applies a powerful mechanical force to open the blade even under heavy coatings of ice.

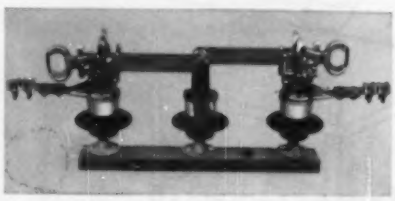
CAST BLADE GUIDES are rigid and wide-flaring to position the contacts properly on each closing operation.

STEEL BASES, hot-dipped galvanized after fabrication, are available to specification.

All of those features, coupled with Southern States reputation for high quality equipment, are why more and more utilities are insisting on the Type PBO Disconnecting Switch. It will pay you to do likewise.



Southern States Type PBO switches are available in all capacities from 400 to 3000 amps and 7.5 to 115 kv for all types of single pole, disconnect switch installations. The type PBO conforms in every respect to NEMA standards.

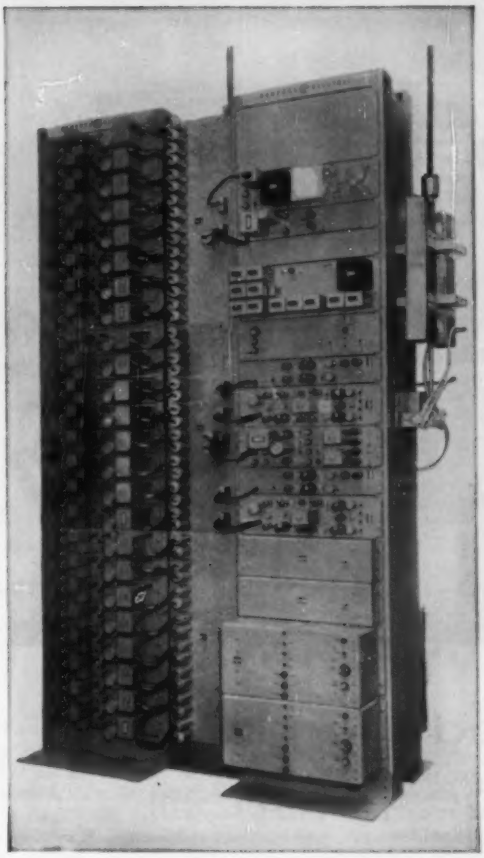


DPBO-2—Southern States double-blade selector switch suitable for applications where it is necessary to supply a load from either one or both of two available sources. Switch construction permits transfer of load from one source to another without circuit interruption.

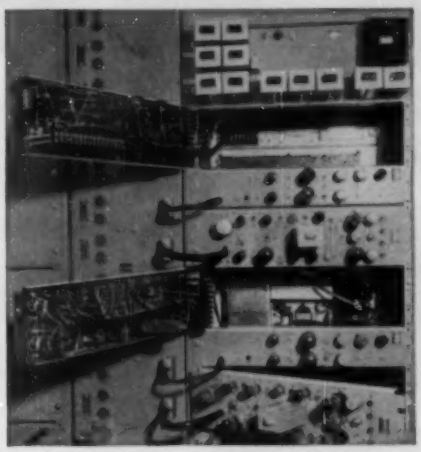
SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

IMPROVE YOUR MICROWAVE RELIABILITY WITH NEW G-E QUADRIPHASE*



*The new General Electric Quadriphase system utilizes four 9 KC sine waves phased in quadrature for selection of the individual channels.



▲ New ease of servicing—units arranged to slide out or swing out for service or inspection without interrupting operation.

◀ G-E 25-channel, 2000 MC Quadriphase microwave terminal, showing all multiplex equipment. Normal and standby transmitters, receivers, power supplies and termination units are mounted on the other side of these racks.

Highly stable channel-determining concept increases "On-The-Air" time

NEW General Electric Quadriphase is the only multiplexing system with channel selection determined by resistance circuits alone. There are no L-C networks . . . no tuned circuits . . . and no delay lines. As a result, you get more reliable microwave communication.

G-E engineers report numerous benefits from the new Quadriphase multiplex design—

MAXIMUM STABILITY AND RELIABILITY—far greater than is possible in multiplex systems requiring tuned circuits.

FEWER CHANNEL ADJUSTMENTS—only 2 necessary—one on the audio level in, and one out.

FEWER TUBES in multiplex, transmitter, and receiver. Total—less than 8 per voice channel!

FAR LESS MAINTENANCE TIME AND EXPENSE—You save on tube inventory and on maintenance time. Because every tube is used well below its maximum rating, G-E Quadriphase gives you a big safety margin, and extra tube life. Simplified circuitry including new printed circuits means quick checking and servicing.

30% LESS FLOOR SPACE FOR RACKS—Packaging is compact—only 4 racks instead of 6 required in previous 25-channel microwave equipment.

See for yourself how to get more reliable microwave communication at less operating and maintenance expense. For complete details about the new concept of G-E Quadriphase, write today. *General Electric Company, Microwave Equipment, Section X1975-11 Electronics Park, Syracuse, N.Y.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

THE *FORWARD* LOOK ...IN TRUCKS!

Dodge has changed the picture on performance, price!

Today there's a changed picture of truck power, payload, price! For example, do you know the answers to these 3 questions?

1—What trucks provide the highest horsepower of the 5 leading makes *in every conventional model*, ½-ton through 3½-ton?

2—What trucks have the highest payload in more models, 1½- through 4-ton, than any other leading make?

3—What trucks have the lowest factory retail price in more popular models than any other leading make?

In each case the answer is, "Dodge '*Job-Rated*' trucks" . . . the trucks with the Forward Look! Find out for yourself how Dodge trucks give you more visibility, more modern styling, more of everything you want in a truck. See your dependable Dodge Truck dealer now.

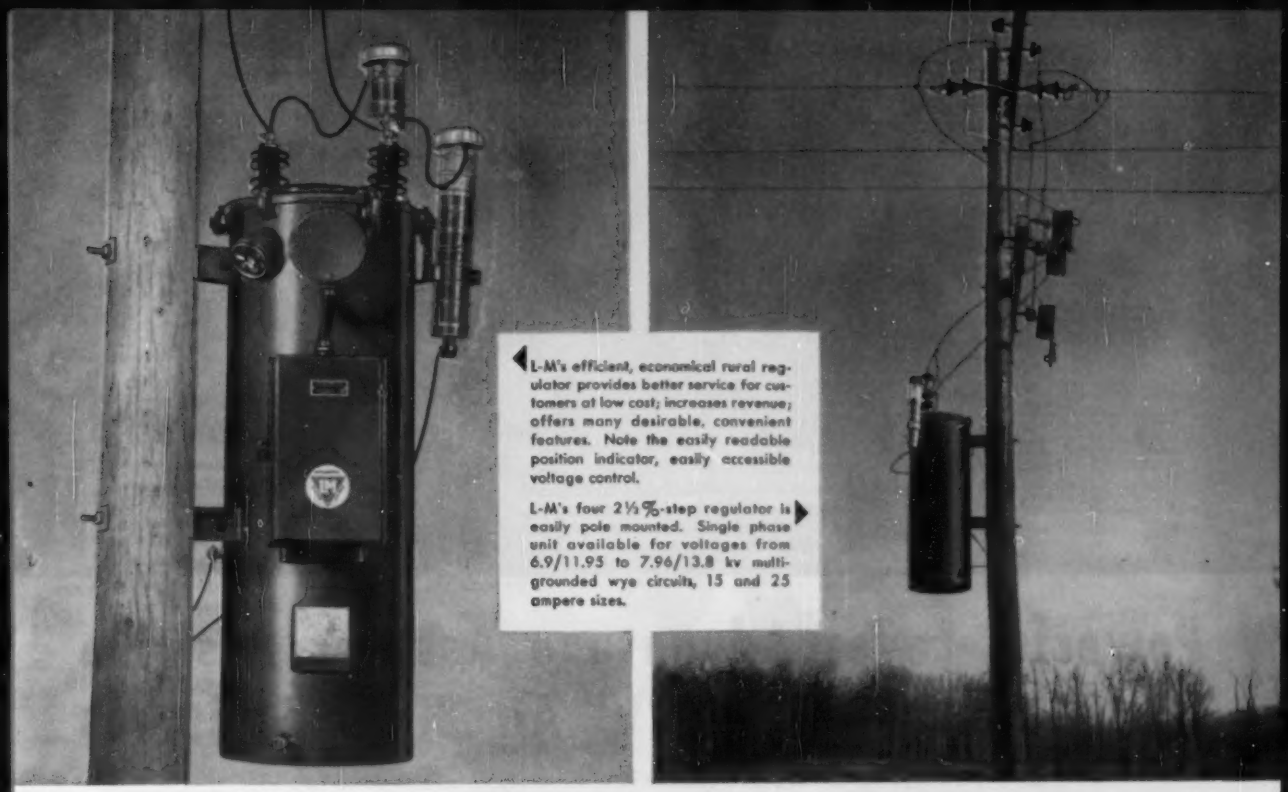
ALL-NEW

DODGE

"Job-Rated"

TRUCKS

PRODUCTS OF CHRYSLER CORPORATION



L-M's efficient, economical rural regulator provides better service for customers at low cost; increases revenue; offers many desirable, convenient features. Note the easily readable position indicator, easily accessible voltage control.

L-M's four 2½%-step regulator is easily pole mounted. Single phase unit available for voltages from 6.9/11.95 to 7.96/13.8 kv multi-grounded wye circuits, 15 and 25 ampere sizes.

L-M Offers New, Simple Regulator For Rural Service at Only $786!

You don't have to spend a lot of money for adequate regulation on rural lines. L-M has developed a new rural regulator, with four 2½% steps, that will give adequate, dependable operation where conditions do not require critically fine regulation.

The use of this regulator increases revenue—probably enough to pay for the regulator in the first year, in many cases. It provides the customer with better performance of appliances, lights and other electrical equipment—and it costs only $786 in the 15 ampere size, $951 in the 25 ampere size.

The L-M regulator is available in 7620 volt rating, 15 and 25 ampere sizes, 60 cycle, single phase. Four 2½% steps provide 10% boost; 7½% boost and 2½% buck; 5% boost and 5% buck; 2½% boost and 7½% buck; or 10% buck. For use on 7.62/13.2, 7.2/12.47, 7.96/13.8, and 6.9/11.95 kv multi-grounded wye circuits (common terminal grounded to tank). Control winding is tapped so control voltage can be 120 volts for either 7620 or 7200 volt primary operation. Contact-making voltmeter can be adjusted to maintain any voltage level between 110 and 130 at recommended band width of ± 2 volts.

Principal Features of L-M's New Regulator

Rugged long-life tap-changing mechanism.

Low contact maintenance.

Detachable, easily adjustable control—with L-M's accurate, contact-making voltmeter. Control can be installed at the base of the pole.

Electrically operated counter on the control, where it is easily accessible for record-keeping.

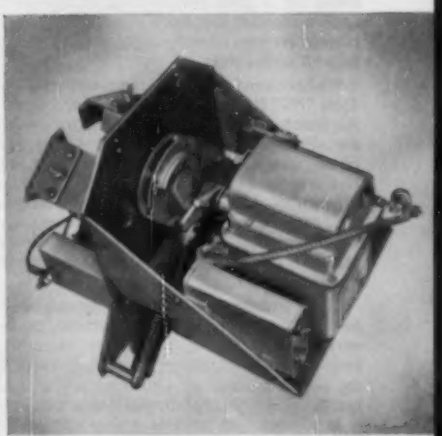
Scientifically designed speed control in tap changer prolongs contact life.

Large tap position indicator easily read from the ground.

Geneva gear drive provides positive contact positioning.

Mechanical stops in addition to limit switches.

Core-coil assembly is L-M's exclusive Round-Wound (TM) design. Tank is filled with ORTO®, L-M's inhibited oxidation-resistant transformer oil.



View of tap changer mechanism showing simplified design and construction.

Get Complete Information

Ask the L-M Field Engineer for details and Bulletin RV1 on the L-M Regulator. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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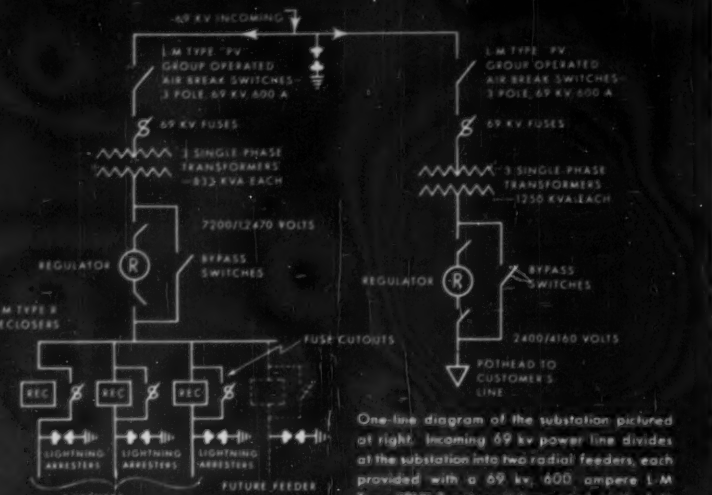
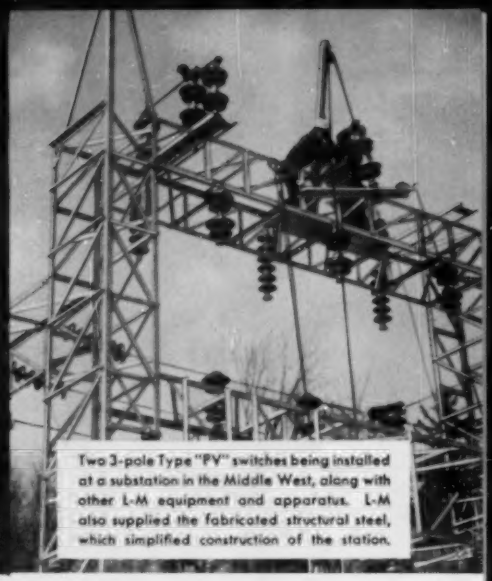
LINE MATERIAL *Regulators*



One-line diagram of the substation pictured at right. Incoming 69 kv power line divides at the substation into two radial feeders, each provided with a 69 kv, 600 ampere L-M Type "PV" 3-pole switch mounted on the L-M steel structure.



Two 3-pole Type "PV" switches being installed at a substation in the Middle West, along with other L-M equipment and apparatus. L-M also supplied the fabricated structural steel, which simplified construction of the station.

Powerful Lever Advantage Assures Positive Operation of L-M's "PV" Air Break Switches

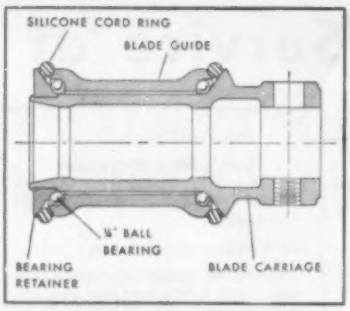
New rotating switch blade concept in switch design provides powerful lever advantage, assures positive operation to open or closed switch position regardless of ice, corrosion, or long periods of non-operation.

The primary function of the air break switch is to provide a means of connecting or disconnecting transmission and distribution circuits. In addition it must meet all of the other requirements for a good switch—ease of operation, convenience and simplicity of installation, high current-carrying capacity, high contact pressure without undue wear.

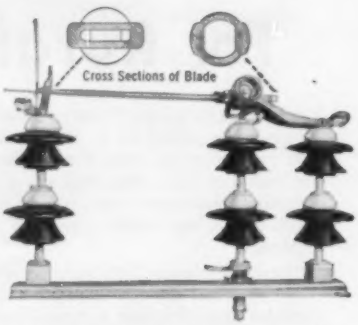
We have amply met these requirements in our Type "PV" Rotating Insulator, Vertical Break, Air Switch. Some of the outstanding features are: silver-to-silver high-pressure contacts; new contact design, with contact pressure easily adjusted in the field; ball bearings lubricated for life with silicone grease and sealed with silicone cord rings; only 6 current interchange points in the entire switch; flexible interphase mechanism assembly, permitting angular distortion of mounting structures.

These switches are for both pole and structure mounting in horizontal, vertical, or inverted position. The interphase assembly, connected direct or indirect, transmits power to the switch mechanism with minimum of lost motion. Every joint of the interphase assembly is lubricated with silicone grease and sealed with a silicone cord ring. Ratings are from 7.5 through 69 kv in 400 and 600 amperes continuous current-carrying capacity. Available with or without horn gaps, from one- to six-pole units.

For complete information on L-M Type "PV" Switches ask the Field Engineer for a copy of Bulletin PSE1 and PSE2, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



Smooth, Easy Operation—The method of sealing a bearing or a joint is shown in sketch above. All the bearing locations or joint locations involved in movement and transmission of power from the operating mechanism to the switch blade itself are protected from corrosion with silicone lubricant sealed in by silicone cord rings.



L-M's new 69 kv Type "PV" switch, above, has major castings of high-grade aluminum bronze alloy, which makes them exceptionally strong, permits lighter cross sections, and is virtually free from corrosion.

New Switch Design Assures Positive Operation

Drawings show blade rotation and rise between the jaw contacts.

1. Normal closed position—blade between contacts and locked in position by the action of the link and crank assembly.

2. Start of opening motion. The blade twists 26 degrees before rising, with all the force applied at the operating handle being imparted to this twisting action, thus assuring positive breaking of any ice or corrosion.

3. The blade is now starting to rise. It has rotated 40 degrees with only a 3 degree rise. Also note how blade rotation has moved the silver inserts away from the silver inserts in the contact shoes, minimizing wear.

4. With approximately 37 degrees crank rotation, the blade has been rotated a full 48 degrees, but has risen only 6 degrees.

5. Blade has risen 9 degrees with a 56 degree blade rotation. On closing the switch, the reverse motion provides the most effective possible ice-breaking action if the switch should be iced open.

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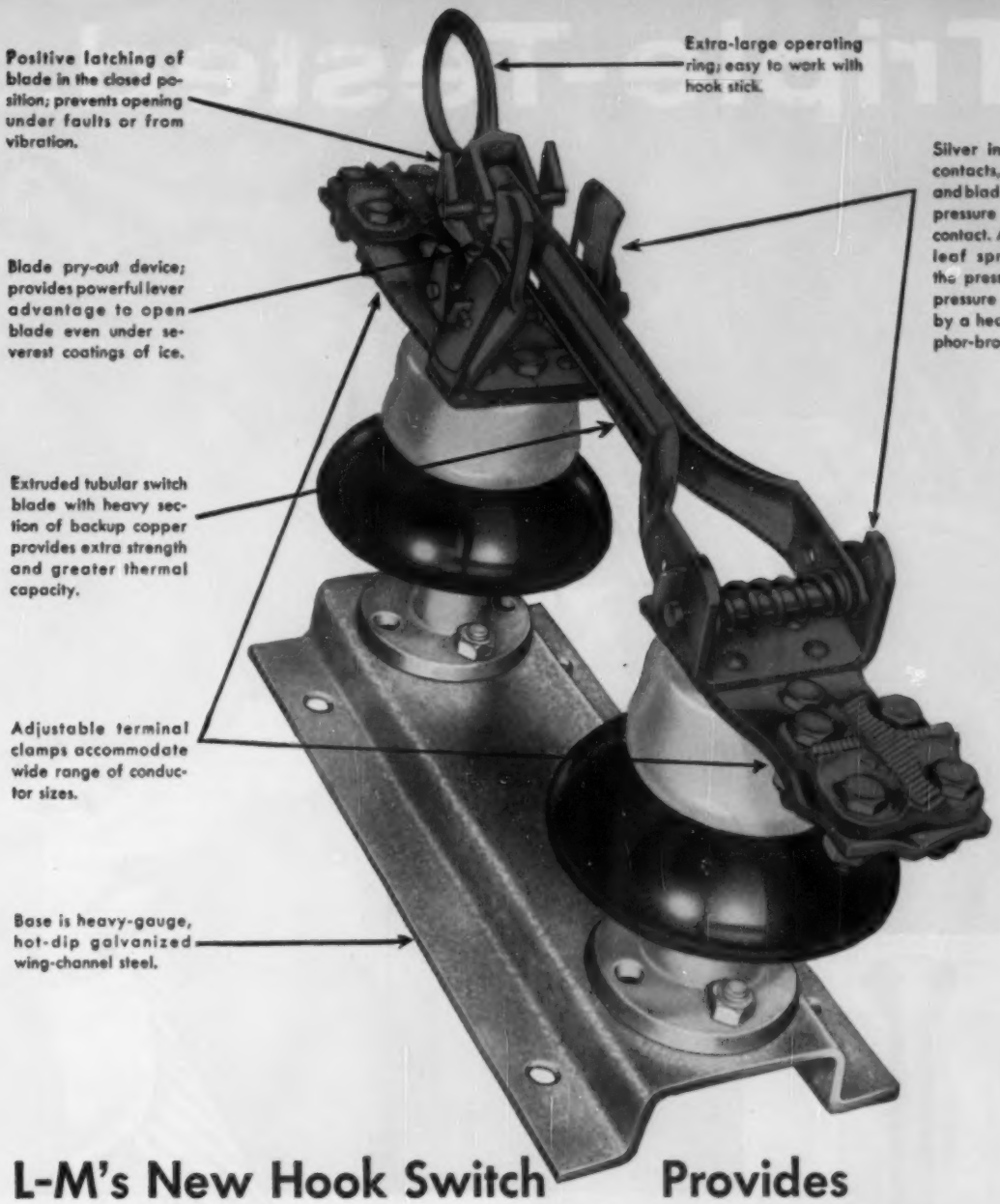
LINE MATERIAL Power Switching Equipment


Positive latching of blade in the closed position; prevents opening under faults or from vibration.
Extra-large operating ring; easy to work with hook stick.
Silver inserts in front contacts, hinge posts, and blade provide high-pressure silver-to-silver contact. At jaw-end the leaf springs provide the pressure. At hinge, pressure is maintained by a heavy-duty phosphor-bronze coil spring.
Blade pry-out device; provides powerful lever advantage to open blade even under severest coatings of ice.
Extruded tubular switch blade with heavy section of backup copper provides extra strength and greater thermal capacity.
Adjustable terminal clamps accommodate wide range of conductor sizes.
Base is heavy-gauge, hot-dip galvanized wing-channel steel.

L-M's New Hook Switch Provides High Thermal Capacity, Trouble-Free Operation

L-M's new outdoor, hook-operated disconnect switch provides high thermal capacity under short-circuit conditions; assures trouble-free service in sectionalizing, disconnecting or by-passing applications.

This new switch can be mounted on either poles or substation structures, in vertical or inverted position.

Outstanding features include: positive blade lock-in and pry-out devices; minimum of current interchange points; heavy copper tubular switch blade; silver-to-silver high-pressure contacts.

Available in single-pole, single-throw and single-pole, double-throw, 400 and 600 amperes, 7.5 kv through 69 kv; 1200 ampere switches in the same voltage ratings will be available soon. For full information ask your L-M Field Engineer, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LM **LINE MATERIAL**

Power Switching Equipment

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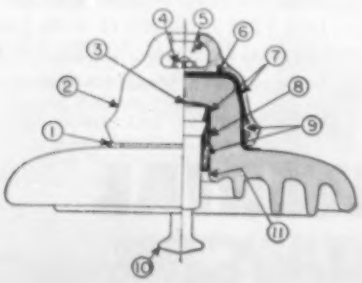
Triple-Tested...

Stainless steel pin, for use in high-contamination or coastal areas. Available in all suspension insulators on special order.



One of Illinois' outstanding porcelain products is this 10-inch suspension insulator. The cutaway view shows some of the features that assure quality.

1. Ample clearance between edge of cap and top of porcelain shield.

2. High-grade malleable cap, treated to prevent embrittlement when galvanized. Forged steel cap also available. Galvanizing is closely controlled in our own plant.

3. Treated fibrous washer provides a cushion between end of pin and porcelain.

4. Spring brass cotter key.

5. Smooth socket, accurately manufactured to standard dimensions.

6. Resilient compound provides cushion between bottom of cap and top of porcelain.

7. Resilient compound applied on inside of cap and outside of pin.

8. Sanded surfaces (controlled particle size).

9. Cemented joint between hardware and porcelain is neat portland cement.

10. Forged steel pin, accurately gauged to standard dimensions. Also available in stainless steel for use in high-contamination or coastal areas.

11. Radio glaze treatment available if desired, though these insulators meet satisfactory radio noise-level requirements without treatment.

Illinois Electric Porcelain... Triple-Tested To Insure Extra Mechanical And Electrical Strength

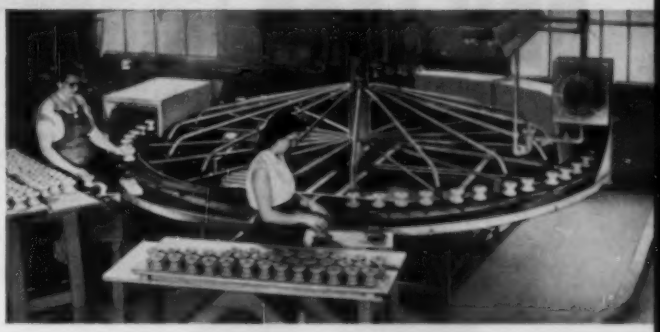
1 Complete laboratory control of materials.

2 Extensive new quality-control system.

3 Rigid final testing.

All combine to insure extremely high quality in the finished porcelain insulators.

by **W. V. SWAN,** Vice President
Illinois Electric Porcelain Company



Here's one of the newest developments at Illinois Electric. On this huge wheel, spool and pin type insulators and wireholders are automatically glazed on all sides and partly dried by warm-air circulation, insuring uniform, complete glazing.

In the two years that Illinois Electric Porcelain has been under Line Material Company operation, we have made extensive changes, from one end of the plant to the other.

A completely new ceramic laboratory has been built, containing the latest equipment for testing raw materials and production methods, and for developing new tests to assure customers that they will get insulators of extremely high quality.

Accurately Controlled Production

The latest precision production machinery has been installed. New, accurately controlled molding, pressing, drying, glazing, and firing equipment assure much more uniform production, and porcelain of greater uniformity in density and strength.

Our facilities include our own completely new, modern galvanizing plant for insulator hardware and fittings. This assures accurate quality control under our own supervision.

Two huge automatic dryers gradually dry the formed porcelain. Heat and humidity are automatically controlled as the ware slowly passes through the dryers. This provides strong, dense ware, free from internal stresses.

Amply Meet EEI-NEMA Standards

The result is that, today, porcelain insulators shipped from this plant are among the highest quality available in the industry. You can buy them with full assurance that you are getting porcelain insulators second to none. They meet EEI-NEMA standards with an ample margin of safety.

Suspension insulators are subjected to simultaneous mechanical and electrical test to destruction—a test performed on a representative quantity of insulators to insure high quality.

A corner of Illinois' complete new ceramic laboratory. The laboratory contains the latest equipment for analyzing materials and testing production processes.

Get Complete Information

Illinois Electric Porcelain Company products include porcelain insulators, hardware, and fittings. These products are sold through Line Material Company. Ask the L-M Field Engineer for complete information, and a copy of the informative Bulletin DL8; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

ILLINOIS ELECTRIC PORCELAIN COMPANY

(a McGraw Electric Company Subsidiary) • Macomb, Illinois

Distributed by **LINE MATERIAL** *Electrical Porcelain Insulators*

(a McGraw Electric Company Division)

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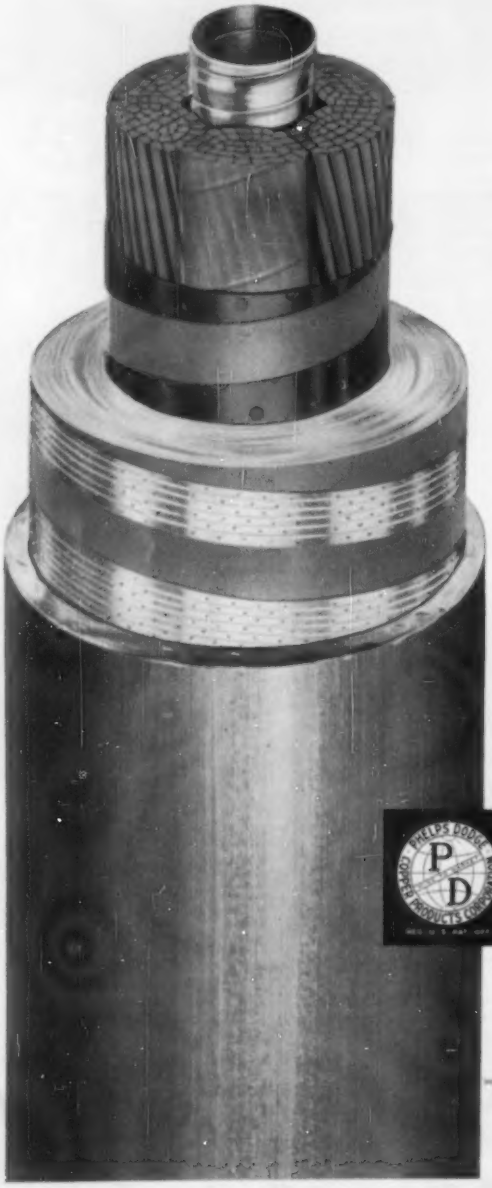
Phelps Dodge can make any Lead Sheath you specify!

No one type is best for all jobs!



Choosing the right lead sheath is strictly a matter of sizing up your specific job. No single type of sheath answers *all* the power cable needs of modern electric utilities.

Phelps Dodge has a wide background of practical experience in developing, testing and manufacturing lead alloys for power cable sheaths. This covers the entire range of lead alloys, including copper bearing or common lead, Habirloy (arsenical) lead or tellurium alloy lead.

Phelps Dodge makes or can make any lead sheath you want. Next time you're looking for a sheath to fit a specific application, consult Phelps Dodge.

PHELPS DODGE COPPER PRODUCTS CORPORATION

40 WALL STREET, NEW YORK 5, N. Y.

Unusual 138-KV oil-filled cable designed for Commonwealth Edison Company of Chicago. One of many Phelps Dodge cable designs with a Habirloy (arsenical) lead sheath.

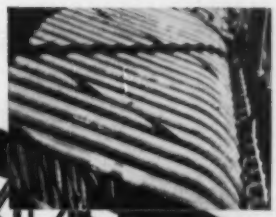
THEY'RE FROM MISSOURI

When Missouri Public Service Company needed a power plant constructed, they compared the performance records and experience of the companies bidding for the job.

They had to be shown; they chose Pritchard.

From the very first day, they started appreciating the close cooperation all the way down the line between Pritchard's staff and their own. This mutual respect and understanding made it possible for the job to get done right.

Pritchard has the ability and experience to handle the complexities of design, engineering and construction of your power plant. Let Pritchard show *you* the way to a profitable installation.



Boiler Water Tubing

INDUSTRY'S PARTNER FOR PROGRESS

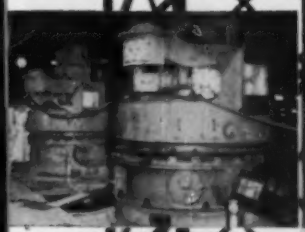
SERVING THE GAS, POWER, PETROLEUM AND CHEMICAL INDUSTRIES

BOSTON, BUFFALO
CHICAGO, HOUSTON
NEW YORK
PITTSBURGH
ST. LOUIS
TULSA

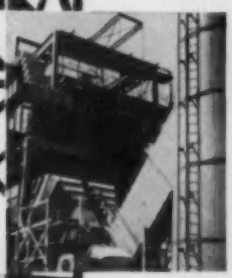
J.F. Pritchard & Co.

ENGINEERS • CONSTRUCTORS

Dept. 452, 4625 Roanoke Parkway, Kansas City 12, Mo.

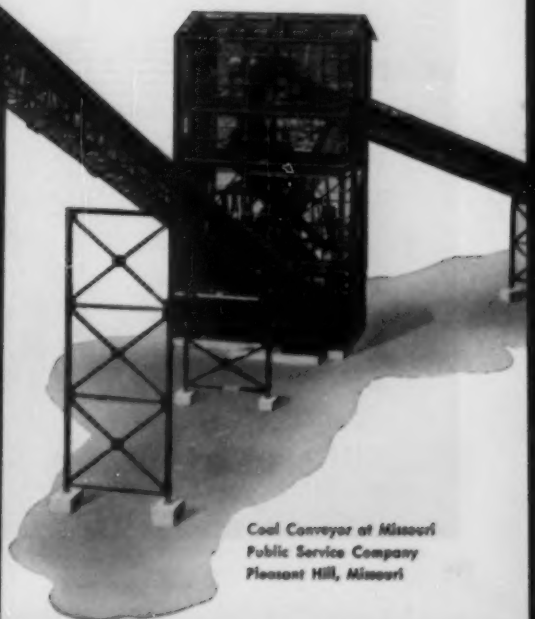


Coal Pulverizers



Induced Draft Fan

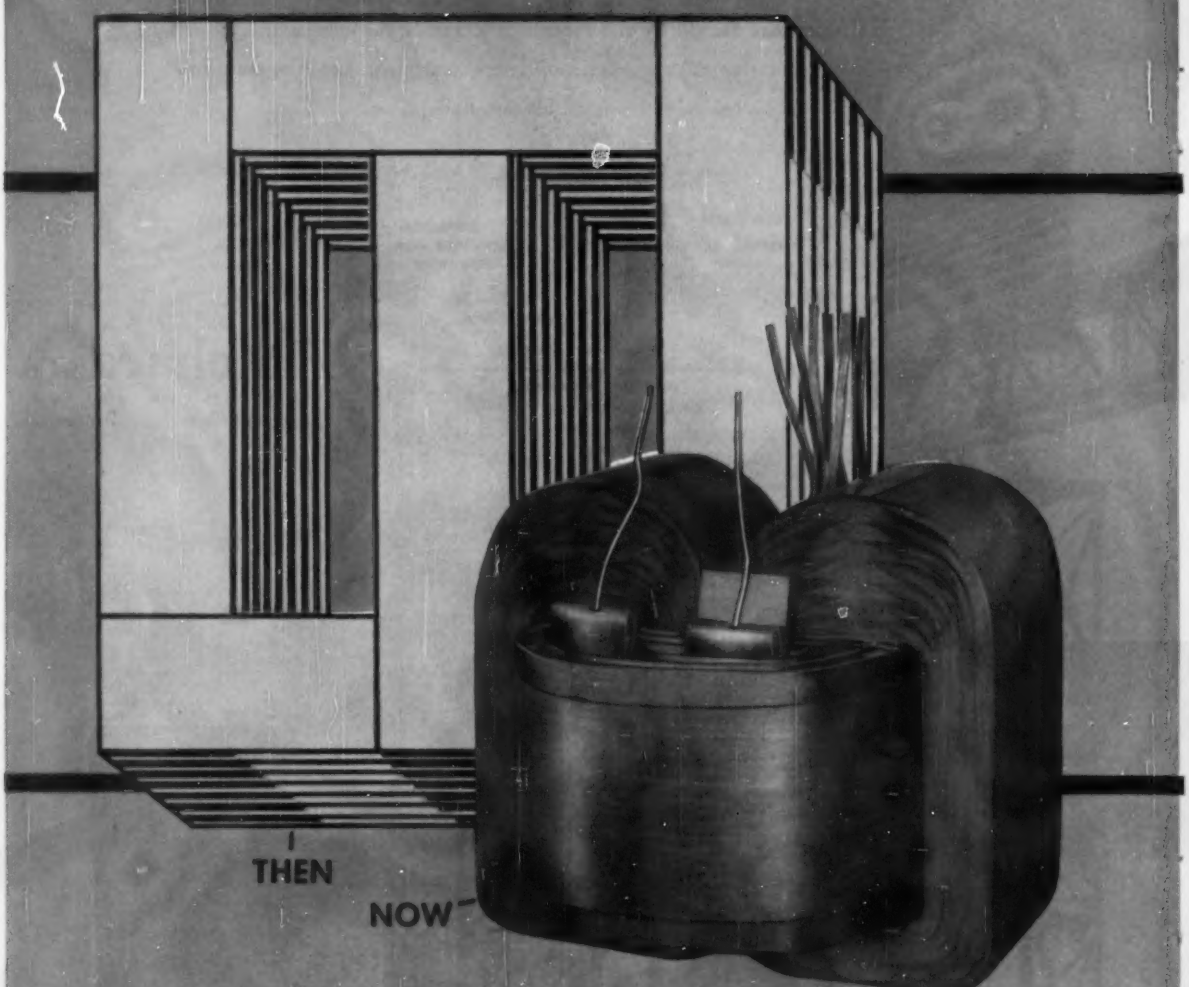
Exterior View of Boiler



Coal Conveyor at Missouri Public Service Company Pleasant Hill, Missouri

the KUHLMAN BENT IRON CORE...

THE SMALLER, THE LIGHTER, THE REVOLUTIONARY CORE



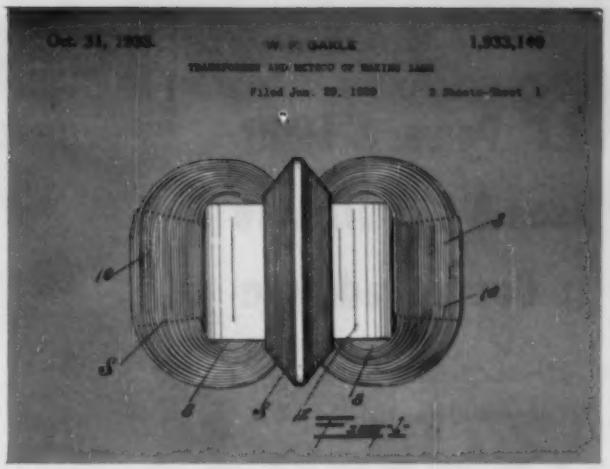
KUHLMAN

KUHLMAN ELECTRIC COMPANY
BAY CITY, MICHIGAN, CRYSTAL SPRINGS, MISSISSIPPI, SALINAS, CALIFORNIA

"an industry first"

Patent #1,933,140 revolutionized core design

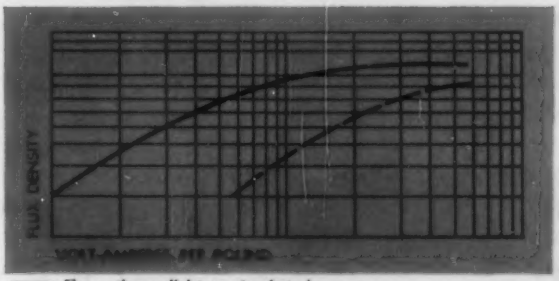
In 1933 Kuhlman was granted Patent #1,933,140 (application filed 1/29/29) on the radically different Bent Iron Core and by 1935 the new core was the first and only core of its kind on the market. The Bent Iron Core not only gained the electrical industries' unanimous acceptance but precipitated a revolution in transformer design, and today, through the use of better materials and improved manufacturing processes, the Kuhlman Core still retains its leadership over other types of cores. Compare the outstanding advantages of the Bent Iron Core's principle of lapped joint construction with other methods of core construction.



CORE CONSTRUCTION FEATURES	A	B	C	KUHLMAN
Flux density in joint area of core	High	Normal	—	Low
Core loss reduced in joint area of core	no	no	—	yes
Exciting current reduced in joint area	no	no	—	yes
Assembly of core after anneal prevents possibility of adhesions between laminations with resulting increase in core loss	yes	no	no	yes
Good space factor — windings in core window	yes	yes	no	yes
Extra copper in windings required by poor space factor	no	no	yes	no
Efficient design with no increase in over-all weights and dimensions	no	no	no	yes

Kuhlman Distribution Transformers are smaller and lighter

The cold rolled oriented silicon steel used in the Bent Iron Core permits the flux path to follow the grain of the steel resulting in a higher flux carrying capacity and a smaller, lighter core. Less copper is needed in the windings, thus reducing the size and weight of the coil. The smaller tank made possible by the Bent Iron Core and coil assembly makes Kuhlman Distribution Transformers easier and less expensive to handle, saves both storage and pole space, and permits the installation of higher KVA on poles.



—— Flux path parallel to grain of steel.
— — — Flux path transverse to grain of steel.

To get Bent Iron Core features order KUHLMAN Distribution Transformers

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K.C. Power & Light Uses 3-Circuit Line In Congested Area

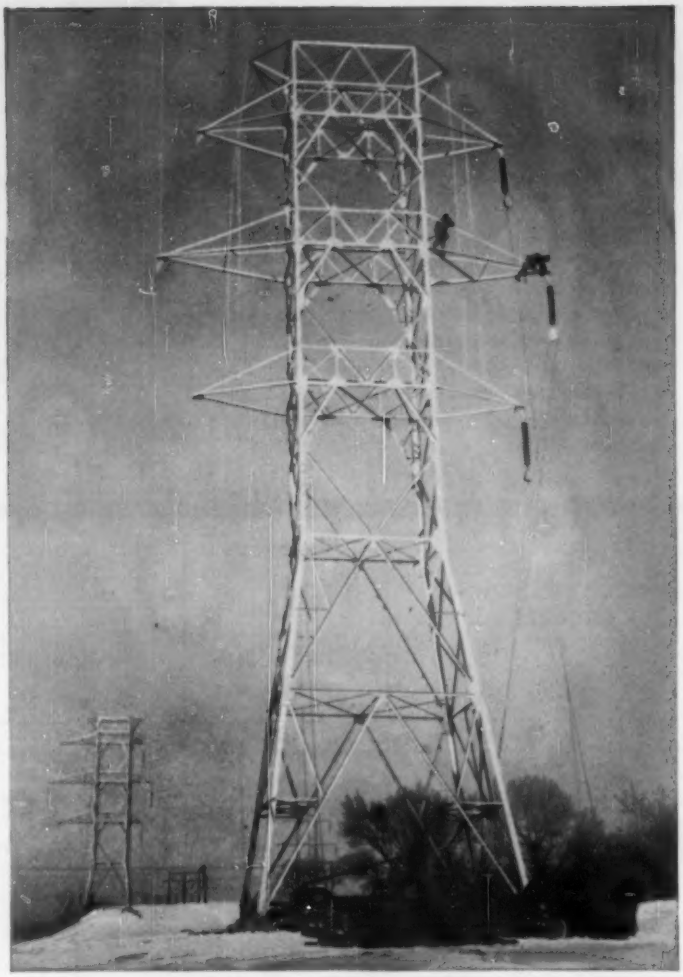
Triple-Circuit Steel Towers Carry Multiple 161-kv Lines Through Dense Industrial Area

A recently completed transmission line of unusual interest is Kansas City Power & Light Company's triple-circuit line in the heavily industrialized Blue Valley district of Kansas City, Mo.

The problem arose because of the need for an additional 161-kv line from the company's Hawthorn Station to a bulk substation at Highway 24 and Manchester Avenue, a distance of 3600 ft over a hill. The nearby industrial concentration made it impossible to obtain a right-of-way in addition to the one used for an existing line between Hawthorn and the substation. The company solved the problem by constructing a triple-circuit line on the existing right-of-way. This permitted stringing of the new line and rerouting of the earlier line, as well as allowing provision for installation of an additional circuit at such future time as growing power consumption requires it.

LOFTY TOWERS . . . Carrying the lines are six big triple-circuit galvanized steel towers, designed, detailed and fabricated by Bethlehem, and consisting of one tangent tower, two angle towers and three dead-end towers. The towers vary in height from 115 to 160 ft, and in weight from 24 to 62 tons, the north dead-end tower being the highest and heaviest.

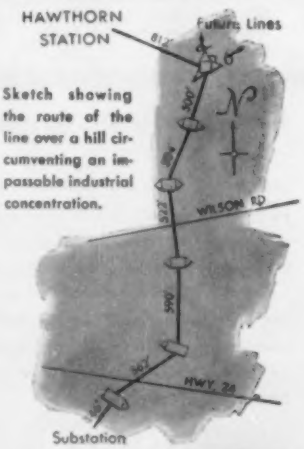
The towers carry ground wires and 61-strand conductors of 1,192,500 circular mils, all-aluminum, strung to a maximum heavy loading tension of 8000 lb.



This photograph, taken in winter when the line was nearing completion, shows a 115-ft 9-deg angle tower in the foreground. In the distance at left is a 130-ft, 24-deg angle tower.

FABRICATED AT LEETSDALE, PA. . . . The tower steel was detailed, fabricated and galvanized at the Bethlehem Fabricating Works at Leetsdale, Pa., near Pittsburgh. Other Bethlehem tower-fabricating works are located in South San Francisco, Calif., and Seattle, Wash. These shops are well equipped to handle your requirements, however large or small they may be.

If you would like to have more information about Bethlehem's design and fabrication of transmission towers, please contact the Bethlehem sales office nearest you.

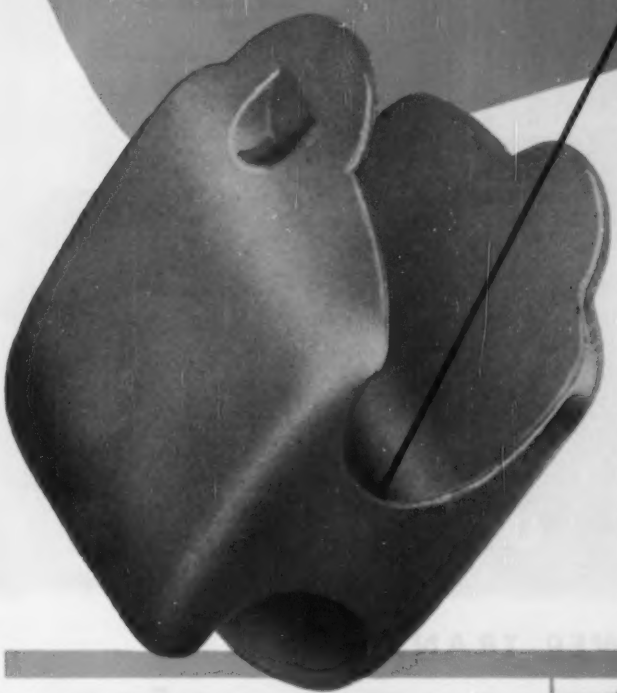


Sketch showing the route of the line over a hill circumventing an impassable industrial concentration.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

The Secret is in the "built-in" Spacer



KEARNEY SQUEEZON

CONNECTORS are designed for greater versatility

The exclusive Kearney design provides the "built-in" spacer. This barrier of metal between the conductors resists galvanic action and, in addition, assures greater conductivity since each conductor is "cold-welded" around its perimeter. Because the wires do not touch each other, there is less danger of flattening or pinching the strands.

KEARNEY SQUEEZON connectors are applied with hydraulic or mechanical tools, in less time . . . at a fraction of the cost of older types of connectors.

For T Connections
Costly special connectors are eliminated by the use of Kearney Squeezon, for aluminum-to-copper connection.

Copper Squeezon
One operation of the Squeezon compression tool permanently bonds this type of joint.

Service Entrance Sleeves
for high-pressure connections of secondary to meter loop.

Bead-Ends
One crimp per Squeezon saves time when multiple connections are used.

Stirrup Tap
Two Squeezons and a short piece of wire make an inexpensive, easy-to-install stirrup, insures a rigid, connection on hot lines.

Aluminum Squeezon
Provides large area contact — prevents cold flow; for aluminum to copper or copper to aluminum.

Line Splice
Line splices are better electrically and mechanically with Kearney sleeves.

For Better Construction . . . Safer Maintenance

JAMES B. KEARNEY CORPORATION

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Specify **KEARNEY PRODUCTS** *The Mark of Quality*

JAMES B. KEARNEY CORPORATION • 4224-42 CLAYTON AVENUE, ST. LOUIS 10, MISSOURI • Canadian Plant GUELPH, ONTARIO

THIS—The new control center groups all indicators on one easy-to-see panel. Nameplate and other accessories for operation and maintenance are also readily accessible within the vertical control center area.

(1) Pressure Vacuum Bleeder
(2) Upper Filter Press Valve
(3) Liquid Level Gage
(4) Pressure Vacuum Gage
(5) Liquid Temp. Indicator
(6) Tap Changer
(7) Nameplate
(8) Drain and Sampling Valve

IN G.E.'s 1955 RM POWER TRANSFORMER

Accessories are easier

We call this important new feature of General Electric's completely-redesigned 1955 RM power transformers the CONTROL CENTER. And that's just what it is—a single, central area for transformer control devices. Instruments and gages have been moved from various scattered locations and grouped on one control panel. The drain valve, nameplate, and tap-changer handle are also located at the control center, and the whole works is recessed behind adjoining cooling tubes. No longer are there protruding indicators or tap-changer operating handles that can be damaged when the transformer is being installed or moved from place to place.

Other features of G.E.'s new 1955 RM power transformer line give you even more value. For instance, American Standard bushings will help reduce your future inventories . . . sled runner base and extra jacking space reduce installation expense . . . Formex* wire and Spirakore* make the transformers smaller and lighter, yet improve their performance and increase their reliability.

What's behind the "extra value" features in the new 1955 RM power transformer? This most extensive redesign, since we introduced the Repetitive-Manufacture program in 1942, is the result of more than 75 product planning meetings with electric utilities. Many of the new features were first suggested by men who actually use and install transformers.

Available in ratings 501 to 5000-kva single-phase and 501 to 10,000-kva three-phase, 69-kv and below, these new 1955 RM transformers are built in accordance with American Standard C57.12a.

To learn more about how they can benefit you, just get in touch with your nearest G-E Apparatus Sales Office, or write for Bulletin GED-2505. General Electric Company, Schenectady 5, New York.

*Registered trade-mark of General Electric Company. 416-2

NOT THIS—On superseded designs accessories are scattered all over the tank, often in hard-to-get-at locations. Indicators and tap-changer handle stick out—are in danger of being damaged when transformer is moved.

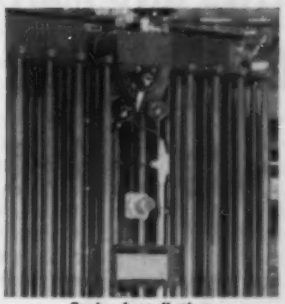
to read—easier to reach

Protected Accessories

Recessed behind adjoining cooling tubes, the control center accessories are better protected against damage.

Improved Visibility

All indicators are grouped on one panel. When warranted by the height above ground, panel is tilted 30 degrees for easier reading.



Easier Installation

One control conduit handles all of the circuits. Conduit is weather-tight, yet can be quickly assembled, without any threading.

Easier Maintenance

All accessories are within easy reach. The shortened tube headers make drain and sampling valve more accessible.

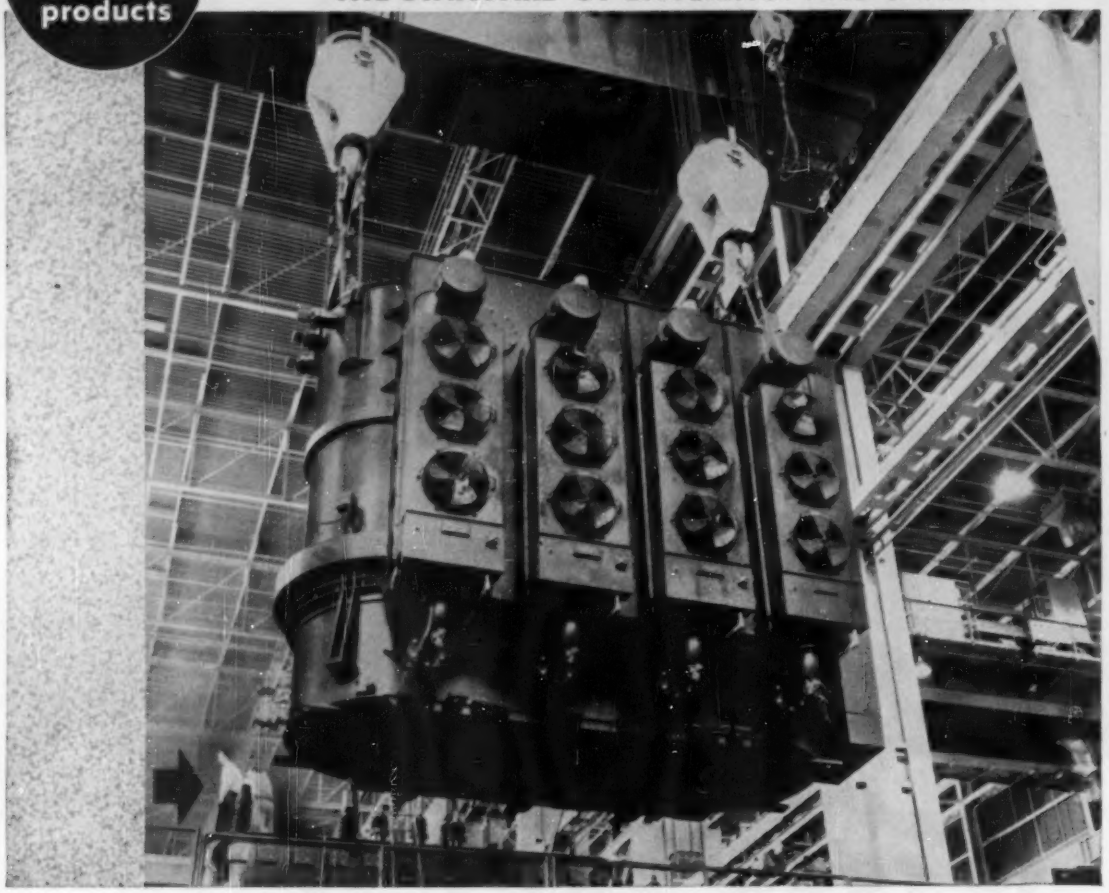
Progress Is Our Most Important Product

GENERAL ELECTRIC

ACCO products

ACCO Registered* Wire Rope Slings

THE STANDARD OF EFFICIENCY AND SAFETY



UTILITIES AND MANUFACTURERS AGREE—

"You Can't Afford Not to Use Them!"

• You can't afford to take chances with equipment like this 140-ton transformer. That's why prominent manufacturers of central station equipment, as well as leading utilities, specify ACCO *Registered* Slings.

For ACCO *Registered* Slings incorporate extra safeguards which make them the safest slings available. Each individual component, made from the highest quality material suited to its use, was tested before assembly. These components were assembled according to carefully engineered and tested designs, to meet uncompromising standards. Construction features exclusive with ACCO *Registered* Slings, such as DUALOC endings, were used to provide extra safety. Then the completed sling was proof tested before being awarded the ACCO Registry Certificate.

The ACCO *Registered* program, with its rigorous quality control, proof testing, and exclusive construction features, provides the ultimate in lifting security and longer sling life. The extra security alone dictates the choice of ACCO *Registered* Slings for utility operations. As one station superintendent said: "In this plant we can't afford to use any other sling."

*Trade Mark Registered

Descriptive literature gladly sent on request

ACCO

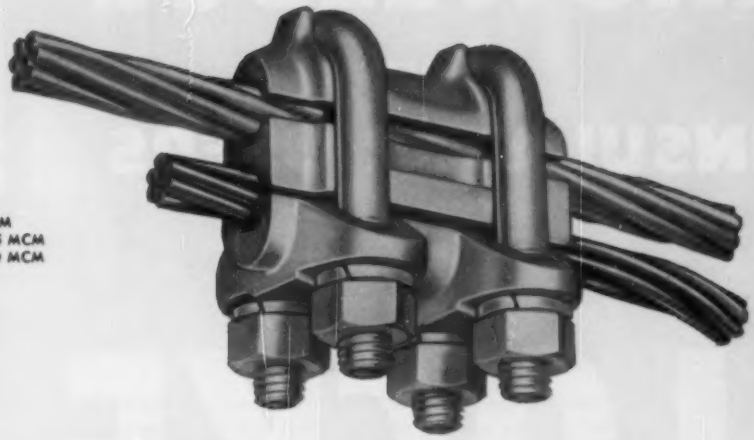
Wire Rope Sling Department
AMERICAN CHAIN & CABLE

Better Value

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn. • In Canada: Dominion Chain Co., Ltd., Niagara Falls, Ont.

CORROSIVE SOLDERING ELIMINATED!

in BLACKBURN'S Heavy Duty Bi-Metallic Connectors

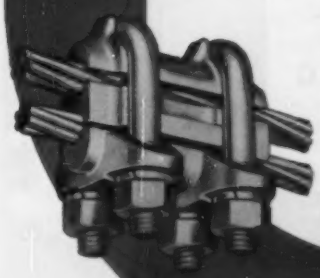


Sizes available to accommodate
ACSR 2—[illegible].4 MCM
Alum. 1 Str.—397.5 MCM
Copper 4 Str.—250 MCM

PRESSURE SEALED, SHRINK-FIT COPPER LINER SEALS OUT AIR AND MOISTURE—PERMANENTLY!

- Manufactured under controlled atmospheric conditions!
- Eliminating corrosive solders and fluxes between copper liner and aluminum casting insures permanent high conductivity.
- Factory applied protective coating prevents oxidation of contact spacer grooves during transit and storage.
- Castings are high-strength, heat-treated alloy with exceptionally heavy cross sections.
- Clamping forces are distributed over extra long surfaces—contour of grooves protects conductor.
- All Aluminum hardware is alumilited to prevent seizing—bolt features rolled threads of greater strength.

Sizes available to accommodate
ACSR 2—[illegible].4 MCM
Alum. 1 Str.—397.5 MCM

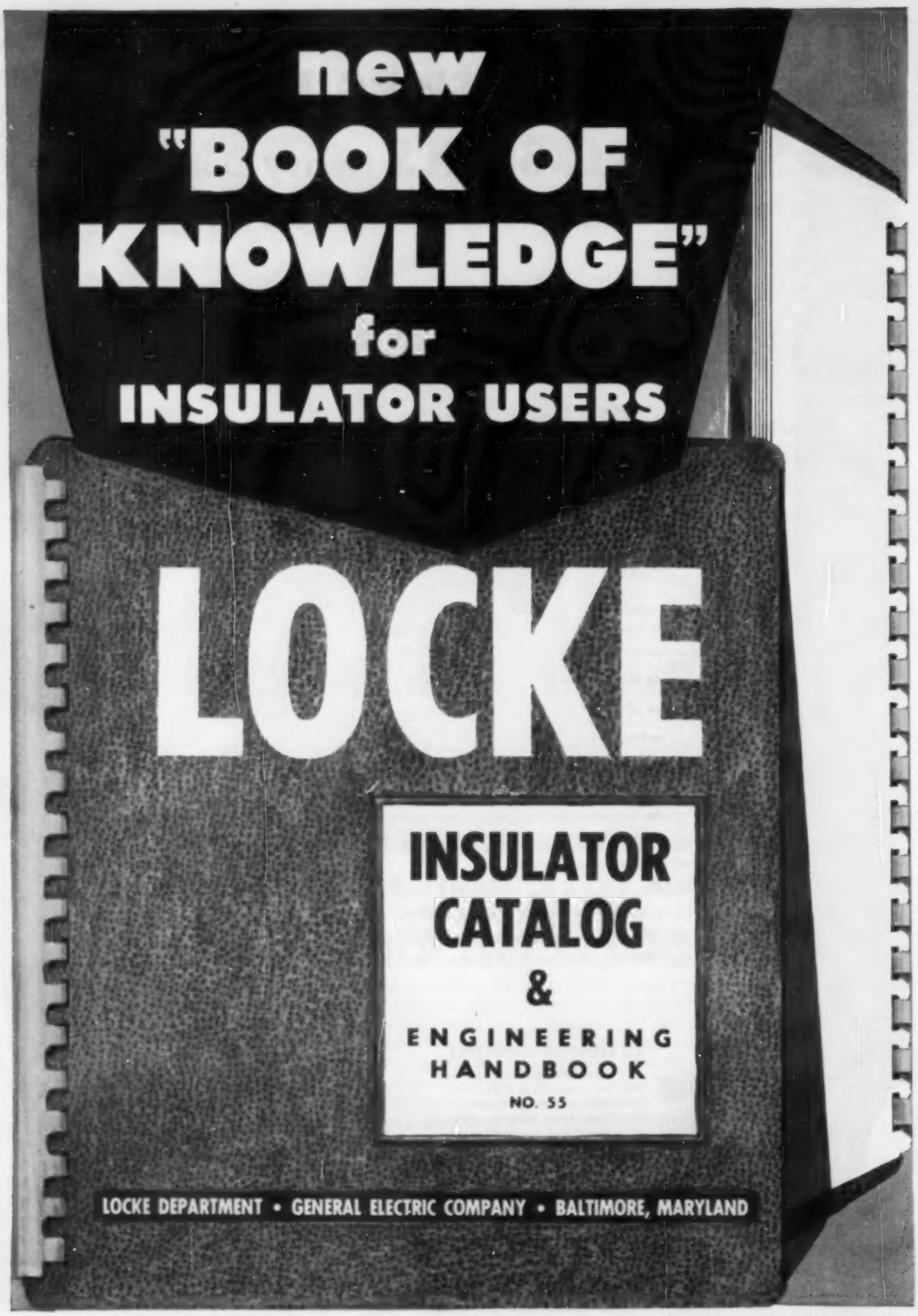


HEAVY DUTY ALL ALUMINUM CONNECTORS

Also available without copper liner for Aluminum to Aluminum. Coefficient of expansion same as conductor. Same high standard of material and construction as above connector.

BLACKBURN Hi Strength CONNECTORS

JASPER BLACKBURN CORPORATION • 32 MADISON ST. • ST. LOUIS 6, MO.
PHONE MAIN 1-2821


new
"BOOK OF KNOWLEDGE"
for
INSULATOR USERS
LOCKE
INSULATOR CATALOG
&
ENGINEERING HANDBOOK
NO. 55
LOCKE DEPARTMENT • GENERAL ELECTRIC COMPANY • BALTIMORE, MARYLAND

Locke's Insulator Catalog and Engineering Handbook

Designed to become your favorite source for complete, authoritative purchasing and engineering information on insulators and insulator hardware.

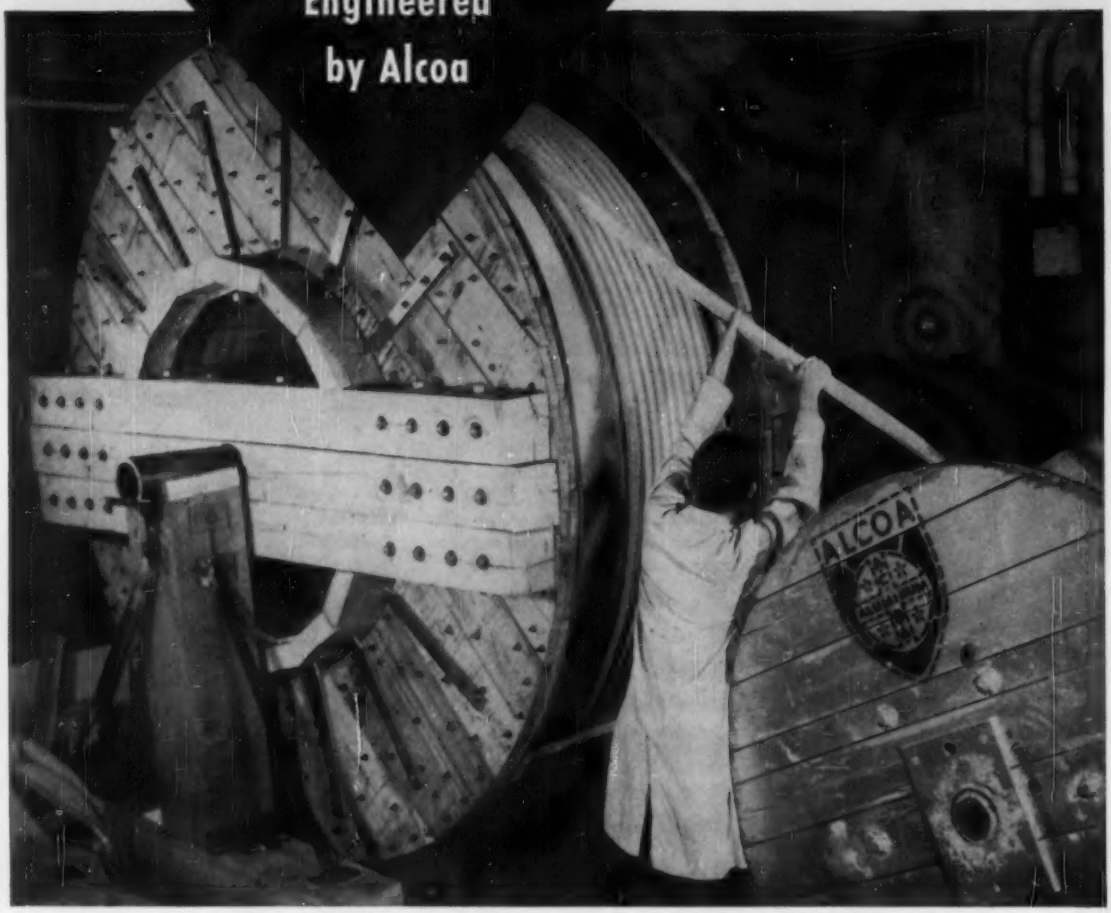
Included in its 233 pages of easy-to-use, alphabetically and numerically indexed material, you'll find these important features:

1. A completely new insulator product section, thumb indexed, makes it easy for you to quickly locate any one of over 800 insulators or insulator hardware items.
2. Complete description of physical characteristics of porcelain.
3. Six pages of clamp recommendations for various conductors.
4. Large section on lightning performance of transmission lines.
5. An expanded section on apparatus bushings with application and maintenance information.
6. Complete listing of all EEI-NEMA Standards, including proposed standards for apparatus insulators. (TDJ-58, 59)
7. The complete American Standards for apparatus bushings and test code.
8. A large general data section including standard insulator tests, cable specifications and many valuable tables for general calculations.

Your copy of this lightweight, spiral bound Insulator Catalog will be supplied by your local Locke Representative.

LOCKE

Mile Long 3,000,000 CM All-Aluminum Conductor Engineered by Alcoa



Your Guide to Aluminum Value

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

A mile of two-inch, all-aluminum cable is used for a 15,000-pound inductance coil in experiments now under way at the Engineering Research Institute of the University of Michigan. Capable of storing three million watt-seconds of energy, the coil was wound with cable that was specially engineered and produced by Alcoa for the university's study of the properties and applications of electric discharges.

The same Alcoa cable engineering and production facilities which solved the unusual technical problems of this project are at your service. They are the best staffed and equipped to handle your special conductor needs.

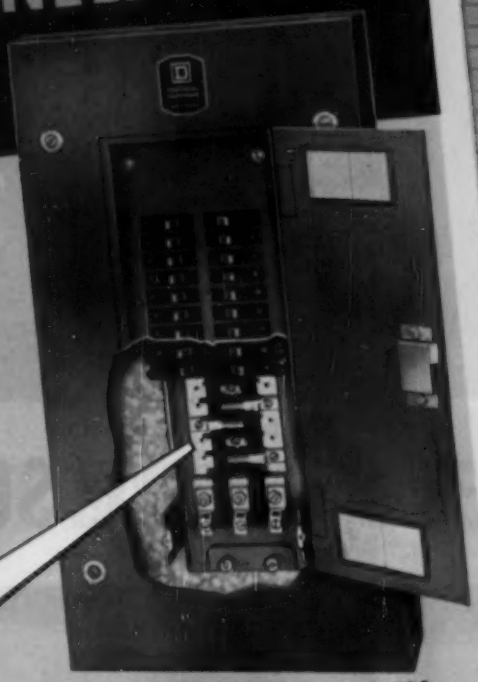
When you have a conductor engineering problem, call your local Alcoa sales office. Or write, Aluminum Company of America, 2312-G Alcoa Bldg., Pittsburgh 19, Pennsylvania.

ALWAYS USE ALCOA® ALUMINUM ACCESSORIES WITH ALUMINUM CONDUCTORS

Terrific!

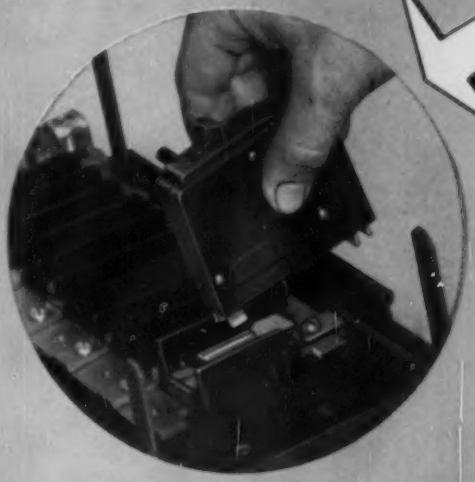
NQO LIGHTING PANELBOARD

with QO... FINEST BREAKER EVER BUILT!



...Get the complete line "Off-the-Shelf" from your Electrical Distributor or have assembled panels shipped right to the job

It's a top quality line throughout! Note the compact, streamlined beauty. A closer look reveals such outstanding features as: Distributed phase bus arrangement with clear identification for simplified load balancing. Adjustable, indicating trim clamps. Galvanized box with large gutters for real accessibility, yet compact enough to mount between 16" wall studs. Most important of all—the new NQO panelboard offers you the finest breaker ever built, with exclusive SWINGRIP mounting.



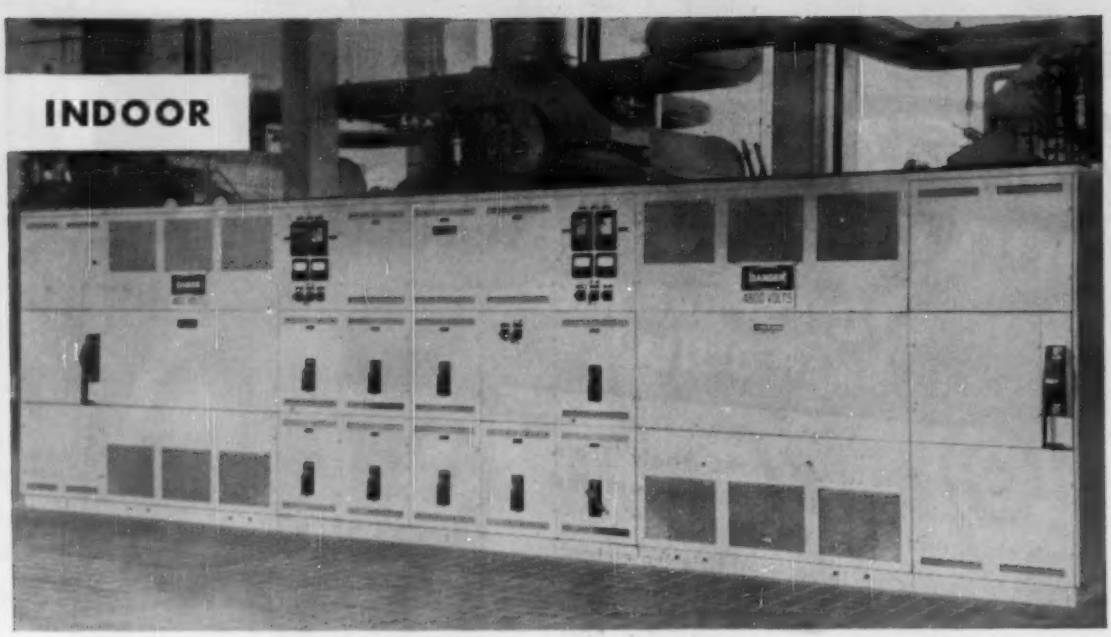
NEW QO BREAKER
with Exclusive SWINGRIP mounting

No other breaker has all these features which make QO the finest breaker ever built!

- Plug-In for maximum flexibility as well as ease of installation and maintenance.
- Quick-make, quick-break mechanism provides positive operation, has excellent "feel". Assures positive operation and long life under all circuit switching conditions.
- Compensated thermal trip enables breaker to carry full allowable load under varying ambient temperatures.
- Sensitive calibrated magnetic trip assures quick and consistent response to harmful overloads or short circuits.
- Non-interchangeable design discourages the use of 30, 40 and 50 ampere units where 15 or 20 ampere breakers have been installed.
- Trip indication on overload or short. Handle moves to middle position.
- Positive action of handle against contact members guarantees circuit opening.
- Compact design—¾" width for each pole conserves valuable space.
- Exclusive SWINGRIP mounting provides easier installation, automatic alignment, positive contact with bus bars.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

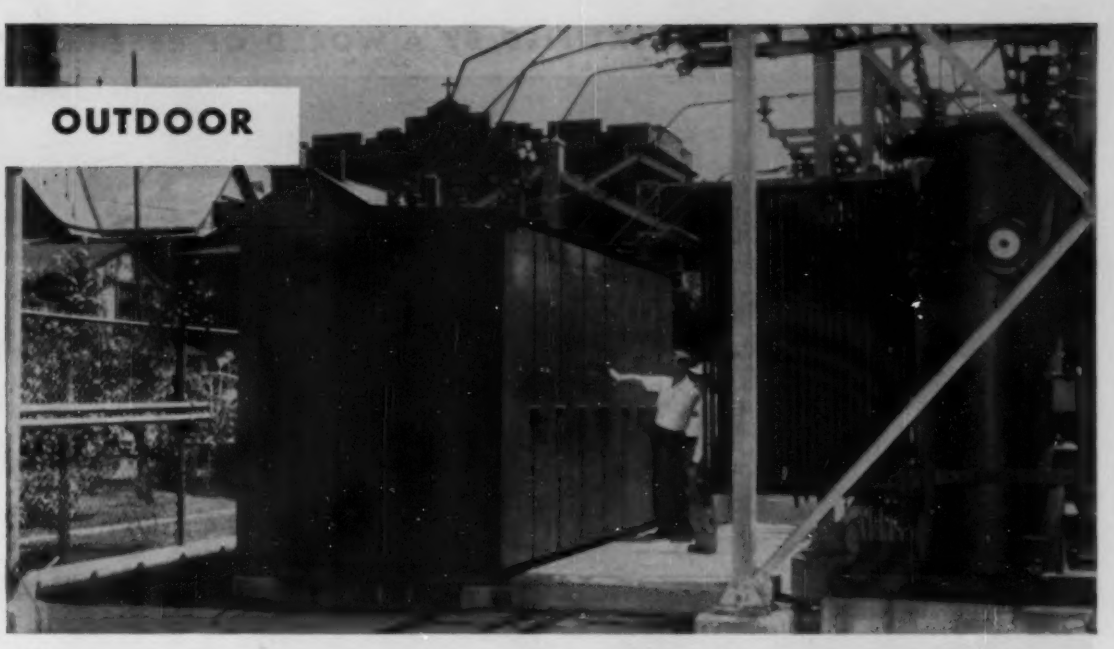
SQUARE D COMPANY



I-T-E, SINGLE SOURCE OF SUPPLY

Primary Section: Maximum protection on the primary side is assured with I-T-E Power Air Circuit Breakers. As an alternate to circuit breakers, roof bushings, throats, terminal chambers, oil cutouts, liquid disconnect switches or air interrupter switches may be furnished.

Transformer Section: I-T-E can supply any type of transformer required for a particular installation. It can be either liquid filled, nitrogen sealed, or dry type. All transformers match and line up with the primary and secondary sections to create one complete unit.



FOR COMPLETE UNIT SUBSTATIONS

Secondary Section: The secondary section consists of I-T-E switchgear. Completely interchangeable, horizontal drawout air circuit breakers are housed in a sturdy structure with completely isolated compartments, large rigidly braced bus, and a superior exterior finish.

You can buy a unit substation either of two ways: a piece at a time (the expensive way), or all at once (the economical way). I-T-E can sell you the individual elements, but recommends that substations be purchased complete, and from a single source of supply.

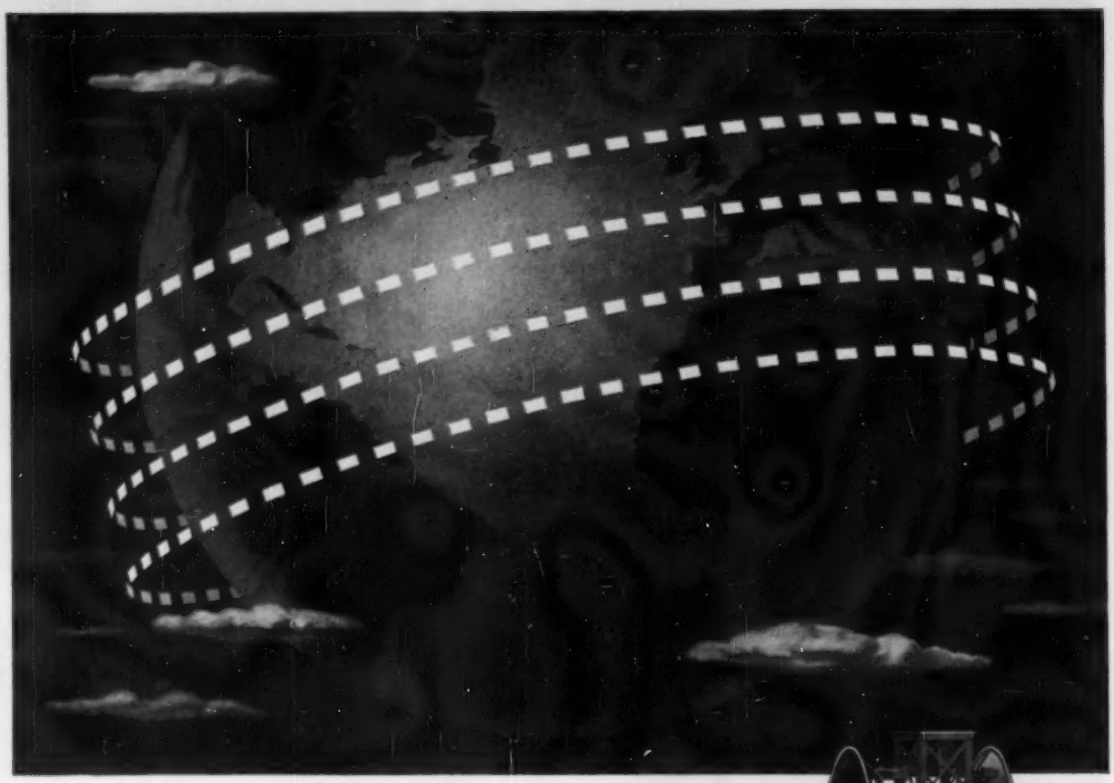
There are good, practical reasons for this. I-T-E's engineering assistance in over-all planning, floor layout, and choice of elements is more valuable to you when it covers the complete substation. Units are packaged and shipped ready to install without delay or complications.

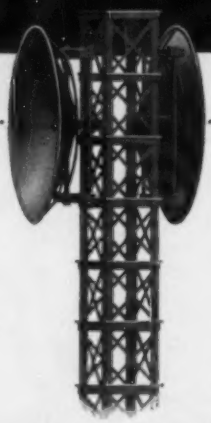
There are further advantages in knowing that one dependable company stands behind your complete installation, and that all parts are designed to function as a unit.

I-T-E Primary and Secondary Unit Substations can be supplied for any application: indoor and outdoor, and in any standard rating. For details, contact the I-T-E sales office nearest you. Look in your classified directory under "Electric Equipment." I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pennsylvania.

I-T-E CIRCUIT BREAKER COMPANY
Switchgear Division

FEDERAL MICROWAVE—"CERTIFIED BY A WORLD OF RESEARCH"





100,000 channel-miles is a lot of microwave experience

In 17 countries today... from Canada to Africa... from Sweden to Australia... multichannel microwave systems designed, manufactured, and installed by companies of International Telephone and Telegraph Corporation are serving government and industry... providing reliable communication over great distances... under all conceivable conditions of weather and terrain.

Consisting of links and networks, these vast and, for the most part, invisible communication facilities represent over 100,000 channel-miles, or more than four times the earth's equatorial circumference.

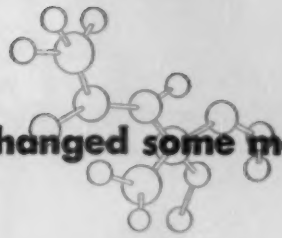
In this country alone, *Federal* Microwave provides tens of thousands of channel-miles... operated by pipelines, power utilities, telephone companies, municipalities, administrations, TV stations and others.

Designing and building multichannel microwave systems to meet the specialized circuitry requirements of such a wide variety of operations calls for experience... for engineering and manufacturing skill that has its roots in the pioneering days of microwave... for know-how that's *"Certified by a World of Research!"*

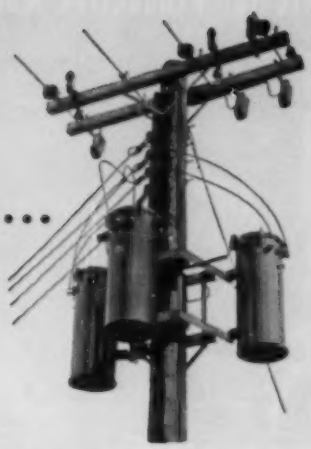
Federal

A DIVISION OF IT&T

Federal Telephone and Radio Company
A Division of INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
100 KINGSLAND ROAD • CLIFTON, NEW JERSEY
In Canada: Standard Telephones and Cables Mfg. Co. (Canada) Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., New York



Du Pont changed some molecules . . .



to produce the higher heat resistance of ALATHON®

polyethylene resin

From the Du Pont laboratories comes "Alathon" polyethylene resin with increased heat resistance for insulation and jacketing. This extra measure of protection for copper and aluminum conductors is in addition to other important properties, such as weatherability.

Jacketing of "Alathon" has outstanding dielectric strength. This material is lightweight and pliable; linemen find it easy to handle. Jacketing of "Alathon" provides real economy because it lasts for years without festooning or splitting. Another advantage is its low rate of water absorption.

For more property and application data on the family of Du Pont "Alathon" polyethylene resins, clip and mail the coupon below.

There is a difference in polyethylenes - specify ALATHON®

polyethylene resin

DU PONT

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
Polychemicals Department
Room 357, Du Pont Building, Wilmington 98, Delaware

Please send me complete information on Du Pont "Alathon" polyethylene resins. I am interested in evaluating these materials for

.....

Name ..... *Position* .....

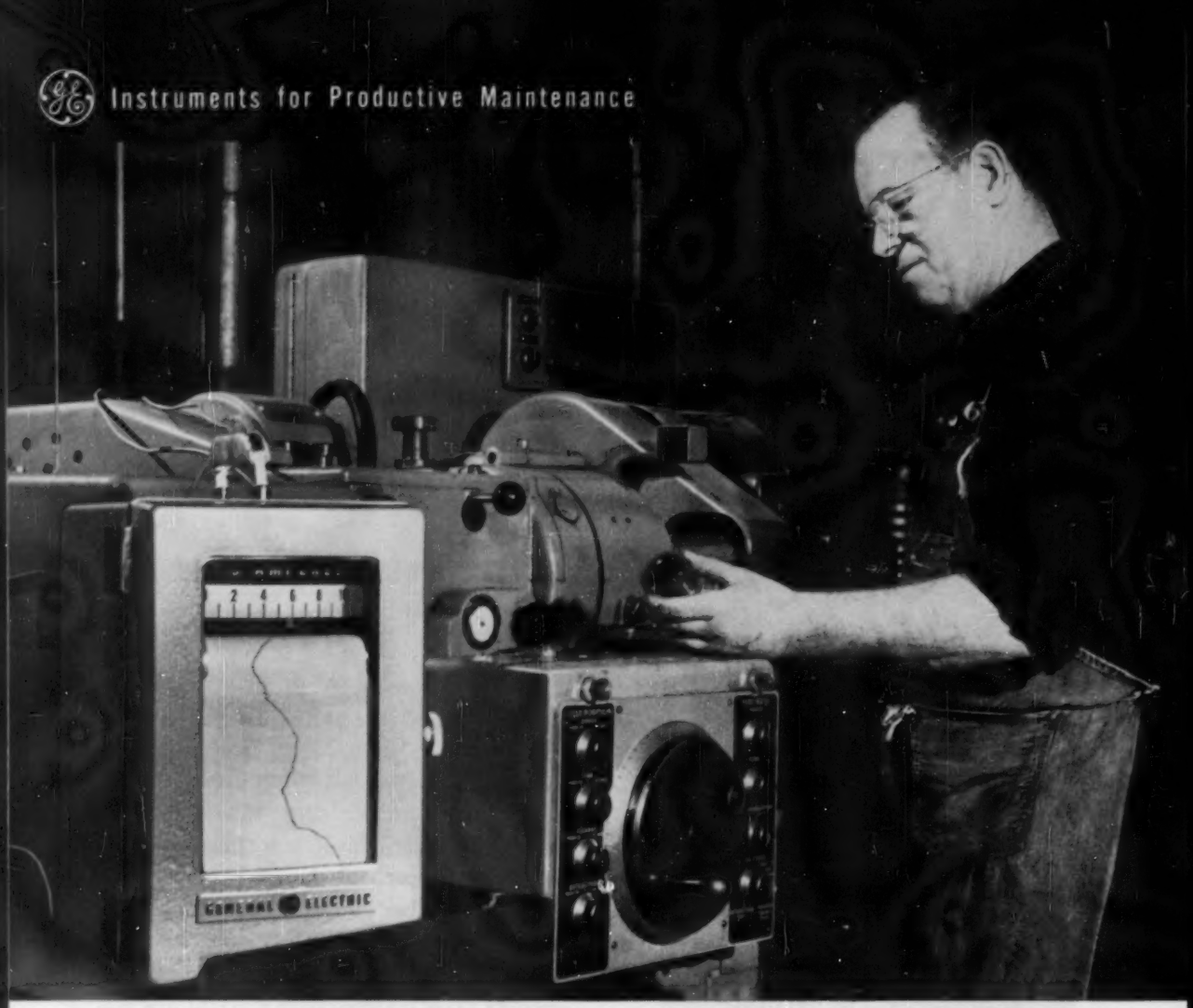
Firm Name .....

Street Address .....

City ..... *State* .....

Type of Business .....

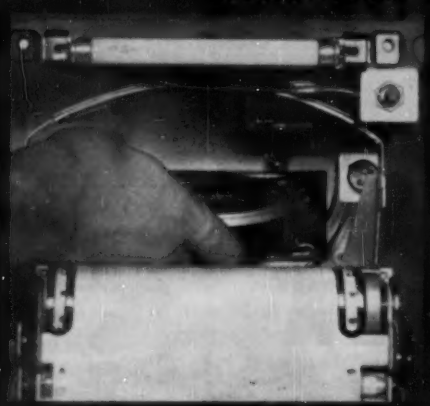
Instruments for Productive Maintenance



NEW G-E RECORDER, designated Type CH, has two modern styles in switchboard cases, in addition to the portable shown in operation above. Checking the efficiency of a lathe is just one of many applications of this new, versatile general purpose instrument.

REVOLUTIONARY WRITING SYSTEM ELIMINATES

New G-E Recorder Makes Clear Records Accurate and Easy to Read



NEW PLASTIC INKWELL holds full 3 ounces or triple amount of open kind. Comes sealed ready for insertion. You waste no time —spill no ink. After use—throw it away.

STURDY CONSTRUCTION of inking system combines fine writing qualities with extra long life. A highly polished, special alloy pen point reduces wear to a minimum.

GENERAL ELECTRIC ANNOUNCES . . .

NEW General Purpose Recorder

G-E RECORDER ASSURES LOW COST, PRECISE MEASUREMENTS, SIX BIG ADVANTAGES INCLUDE FIRST THROW-AWAY INKWELL

General Electric's new general purpose recorder is more serviceable, versatile, readable and durable than any other recording instrument available today—plus having the first throw-away plastic inkwell in recorder history. Charting a continuous record of an electrical quantity against time, different models of the new instrument can measure and record current, voltage, power, frequency or speed.

REVOLUTIONARY NEW inking system assures a clear, clean record and eliminates the problems of open inkwells found in all other recorders. The new G-E recorder provides six major benefits: Servicing time and costs are cut in half, spring clock runs up to 60 days, 28 different chart speeds are available, instrument is durably built for long life, records are easy to read, and maintenance is simplified.

FOR FURTHER INFORMATION, contact your nearest G-E representative, or clip and mail the coupon below.

Progress Is Our Most Important Product

GENERAL ELECTRIC

TROUBLESOME SERVICING OF OLD STYLE INKWELLS

SECTION D582-1
GENERAL ELECTRIC COMPANY
SCHENECTADY, NEW YORK

Please send me the colorful, easy-to-read bulletin GEA-6204 on the new G-E Recorder.

Name.....

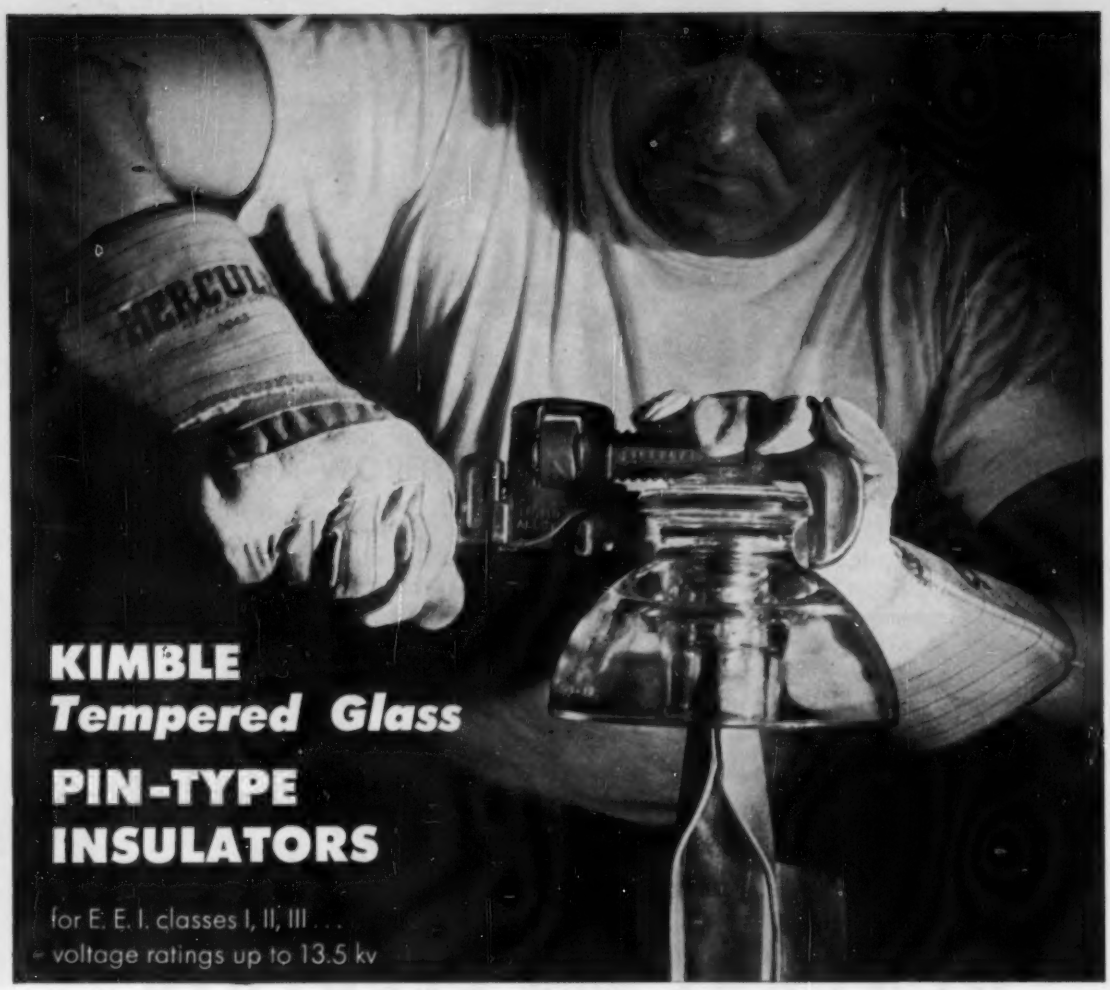
Company.....

Street.....

City..... Zone... State.....

G-E RECORD ROLLS are 150 feet long and service is simple and easy. Handy side paper indicator tells quickly how much is left on paper roll, saves time, steps.

EASY-TO-HANDLE portable G-E instrument gives dependability throughout rough operations, as do other two models. Service, when needed, is quick and easy.



Stronger than the pin that supports it

SO STRONG . . . Torque test shows strength sufficient to strip threads on lead bushed pins and actually twist pole top steel pins.

This great strength saves installation time. It is not necessary to loosen Kimble tempered insulators for line-up with the conductor. Their strength will always allow another quarter-turn.

If it's on the pin, it's in service

In the event of shattering due to severe mechanical shock, insulator disintegrates into many small, non-sharp fragments. Trouble shooters can locate broken insulators—fast.

What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. Kimble insulators are more than strong enough to meet the severe tests required.

Why not see how tempered glass can cut your line maintenance costs. Write for descriptive folder that gives complete details. Address: Kimble Glass Company, subsidiary of Owens-Illinois, Dept. EW-7, Box 1035, Toledo 1, Ohio.

KIMBLE INSULATORS
AN (O) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES • TOLEDO 1, OHIO

Line construction bodies for light to heavy-duty. Crew compartments optional. Efficient tool compartments and drawers.

Bodies for truck driven air compressors. Designed to accommodate hose reels, tapping machines, jack hammers, etc.

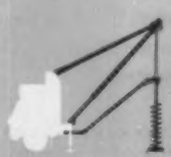
Service bodies for chassis up to 1½ ton. Lengths, 72", 75", 84", 90" and 102".

Hydraulic Derricks designed for front or rear mounting. Capacities to 12,000 lbs.

Light-duty power operated derricks for front or rear mounting. Operating range of 146°.

Ladders to 40' with all phases completely hydraulic. Pump actuated by P.T.O. or separate engine drive with electric starter.

Mechanical Ladders expertly engineered and counterbalanced for effortless handling. Maximum heights from 23' to 40'. Swings 360°; angles to 72°.



Portable mechanical and hydraulic earth borers with optional rotation.

Wide variety of pole and reel trailers. Standard and special. Many optional features.

Hydraulic jacks, controlled from rear of truck. Rigid mounted or patented Holan self-stowing types.

Hydraulic towers with rotary, stationary, or transverse platforms. Exclusive box-girder telescoping mast.

TOWER OF STRENGTH

Holan hydraulic towers make high-up work safe and easy . . . like working on the ground.

A powerful, telescoping double-acting cylinder, supported by a telescoping box section, smoothly lifts the platform into the sky. Every movement of the platform — up or down, around or sideways — is controlled by push-buttons from the platform or the cab.

For crew safety, there's a 3-foot side railing and insulation throughout. All told, you have the last word in convenience, safety, and easy maintenance.

If you work high up, get the low-down on Holan hydraulic towers.

THREE TYPES

Transverse platform — moves laterally, 11 feet* either way. 4' by 7' platform.

*Can be made to move laterally 14 feet for special applications.

Rotary platform — rotates 330°. 4' by 11' platform.

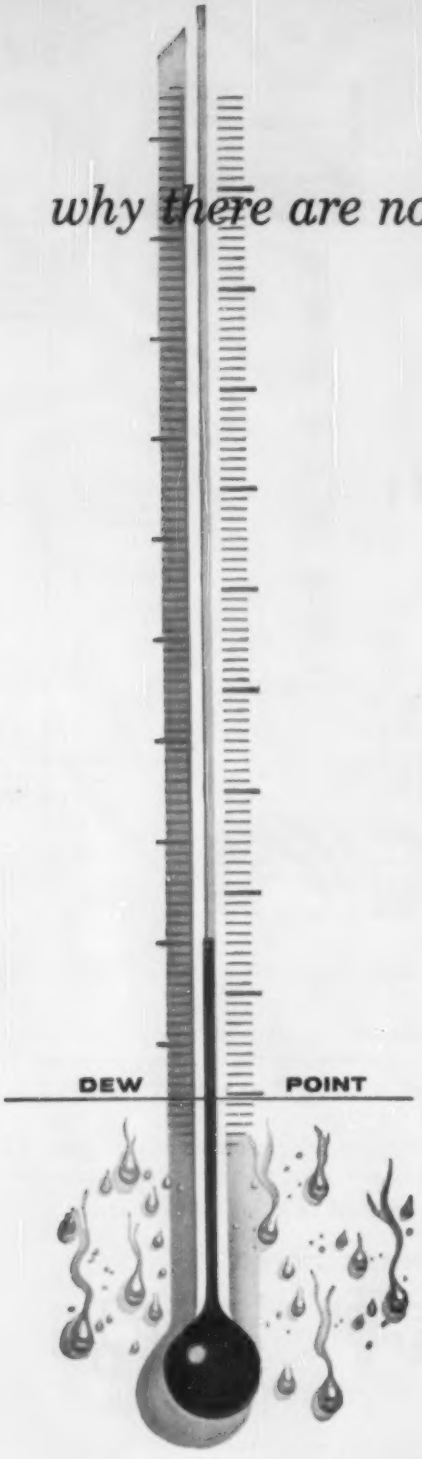
Stationary platform, 4' by 7' platform.

Three models for each type — maximum heights of 17', 23'6" and 30'. Can also be furnished for 35' height. All towers collapse to about 10'3".

"You"-tility Engineered by J. H. HOLAN CORPORATION

4100 WEST 150 ST. • CLEVELAND 11, OHIO

THE NAME THAT MEANS WORK SIMPLIFICATION



why there are no cold spots and less corrosion in the Ljungstrom® Air Preheater

In the Ljungstrom, the heat-transfer surface rotates alternately through the gas and the air streams . . . keeping heating elements consistently hotter than other types in equivalent service. That's why there are no cold spots . . . and less corrosion in the Ljungstrom.

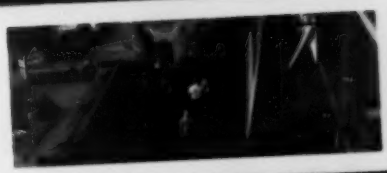
Even though corrosive action is slow, some does take place at the cold end of the Ljungstrom. This presents no problem, since the cold end is sectionalized to permit easy reversal and almost double life. Reversing or replacing the cold end does not disturb the rest of the elements and takes just a few hours.

Get all the details on the Ljungstrom Air Preheater. Send for the new, free, 38-page reference manual, "Ljungstrom Air Preheaters."

Advantages of the Ljungstrom Air Preheater

- Size for size, recovers more heat than any other type.
- Reduces fuel consumption. Permits use of lower-grade fuels. Increases boiler output and reliability.
- Eliminates cold spots . . . keeps corrosion to a minimum.
- Easier, faster to clean and maintain.
- Requires far less supporting steel and is quickly erected.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.



MOLONEY ELECTRIC

ENGINEERING
FACILITIES
EXPERIENCE

Engineering leadership, teamed with the finest manufacturing *facilities* and long *experience* have given Moloney Transformers operating records that are unequalled in the industry.

MOLONEY ELECTRIC COMPANY

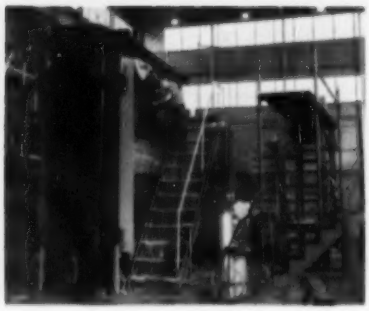
Transformers exclusively since 1896

FACTORIES AT ST. LOUIS, MO., AND TORONTO, ONT., CANADA

Bulletin PT2805-355

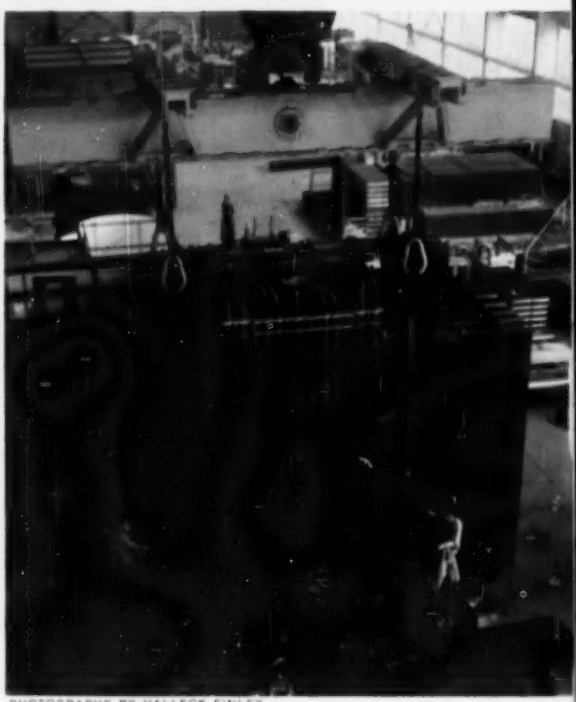
FABRICATION AND ASSEMBLY SKILL

. . . the final link between design and product.



Engineering and facilities require this final step of fabrication and assembly to insure that transformer operating records become realities as planned. At Moloney, skilled personnel of long experience combine pride of workmanship with superior engineering to produce the finest transformers.

MESS-26



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Litho in U. S. A

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EDITORIAL

Enterprise Unlimited in the Pacific Northwest

Electric companies in the Pacific Northwest propose a constructive solution to that region's constantly growing power requirements. Briefly and generally stated, it is this: Clear the way for free enterprise to finance and help construct the generating facilities necessary.

This proposal, which has numerous and specific applications, draws strength from the fact that its goal is to provide plentiful and economic electric power for the region. It is an honest and realistic attempt to supply the essential power.

In other parts of the country the proposal would not be novel nor newsworthy. But the situation in the Northwest is historically and dramatically different (EW, July 4, p 62). There the federal government has spent more than $1½ billion on projects which contribute around 50% of the area's power supply. The Army Corps of Engineers, which builds a large share of the federal power projects over the nation, recently estimated it has been spending nearly half of its total civil works funds on projects in the Columbia Basin. Bureau of Reclamation, another federal agency which builds power projects, spends a similar portion of its entire budget on projects in the Northwest.

In fairness to other sections of the nation, Congress and the Administration aren't inclined to keep up this pace. And even this pace is far too slow to meet the rapidly expanding power requirements in the Northwest. Company and government power men estimate the region will require an outlay of some $3 billion or more for additional power generation during the next ten years. Judging from performance during the past seven years there is little reason to believe that the federal government will put up more than a small share of that amount.

Thus it is not merely because of philosophical leaning but out of sheer necessity that private capital must furnish the wherewithal to build the electric power generation in that rich and ever-expanding region. And at the present time the funds available to private enterprise for electric power development in the Northwest appear practically unlimited.

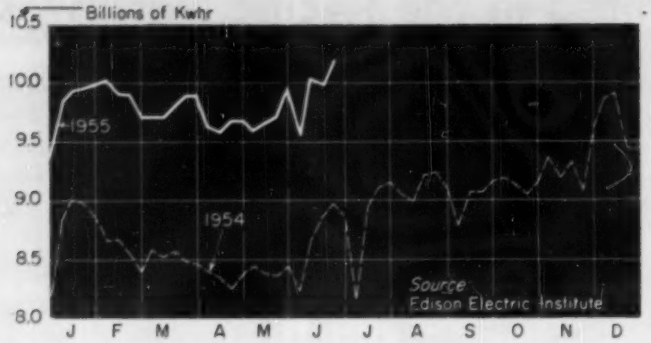
Electric company managements in the area are keenly aware of their responsibility and their capacity to allay the generation squeeze that faces the Northwest. They are going ahead with construction already approved and have scores of other firm proposals before appropriate agencies for staving off any power shortage. Every company is doing its part.

But because hydro generation is, and for the next decade will probably remain, the most economical source of electric power in the area, utilities there must look to Congress and the Federal Power Commission for authority to proceed with their project proposals. Before these forums the utilities continue to run into the die-hard opposition of federal power advocates. These advocates appear willing to drive the Pacific Northwest to economic stagnation rather than permit non-federal entities to develop hydro power on the large scale which the region demands.

This group cannot hope to obtain sufficient funds from Congress to meet more than a small part of the rapidly increasing loads. They can delay and perhaps for a time block much of the proposed electric company development. These federal power advocates offer no constructive alternative for the situation.

As long as there is reasonable assurance of a fair return, private enterprise can furnish the risk and the debt capital necessary for the task ahead. Today it is free enterprise and private capital that can and will furnish the Pacific Northwest the power for unlimited expansion and unlimited prosperity.

ELECTRICAL WEEK



OUTPUT

Week Ended July 2
10,138,000,000 Kwhr
Up 14.9%

Atomic Energy Commission requirements — 867,000,000 kwhr (Electrical World estimate). Excluding AEC, output increase was 9.3%

Per Cent Change from Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
July 2	+14.9	+10.5	+11.1	+22.8	+0.9	+20.5	+5.2	+11.4	+13.4	+6.8
June 25	+13.9	+7.8	+11.3	+20.5	−0.6	+21.8	+0.6	+8.6	+13.3	+6.4
June 18	+12.8	+8.5	+9.1	+17.7	+0.3	+21.3	−1.5	+9.1	+9.5	+10.7

Seasonally Adjusted Index 193.9 Week Ago 194.8 Year Ago 169.3

The Issue's Highlights: President Eisenhower announces he will cancel Dixon-Yates contract if Memphis is serious about its announced intentions to build plant of its own. Decision will be forthcoming in about two weeks when Budget Director Rowland Hughes is expected to complete restudy of contract ordered by the President . . . U. S. exhibit for United Nations' atoms-for-peace show in Geneva next month has dress rehearsal before shipment . . . Army engineers dedicate three dams in Northwest . . . New York's Gov Harriman approves revised Alcoa contract for St. Lawrence River power . . . Today's concern with increased transmission capability to carry double loads tomorrow finds utility and manufacturer's engineers scrutinizing the extra high voltages and their parameters. One evaluation of these parameters appears in this issue. Another article deals with a survey that indicates the part cables will play in this growing trend to EHV.

Kalamazoo, Mich., City Commissioners have approved by 5-to-1 vote sale of the municipal electric system to Consumers Power. In an election earlier, voters of the city had also approved the sale. Consumers had offered to purchase the system for $1,625,000. In another action, Consumers has asked Michigan PSC for approval of accounting procedures on $2.5 million it plans to invest over five years in atomic energy plant to be built by Atomic Power Development Associates.

Proposal for first nuclear power plant for REA cooperative has been made by the Rural Cooperative Power Association of Elk River, Minn. It has asked AEC and REA to approve plans and provide financing for 22-Mw nuclear power unit which it says will cut its Elk River Plant production costs from 9.25 to 6.4 mills. Elk River proposal asks for loan from AEC for construction of reactor and one from REA for turbo-generator facilities. American Machine & Foundry would provide reactor.

Charles E. Kohlhepp, recently appointed president of Jersey Central P&L, has also been elected president and director of New Jersey P&L, A. F. Tegen president of General Public Utilities has announced. Kohlhepp formerly was president of Wisconsin PS. Hugh Thuerk, former president of NJP&L, becomes executive vice president of the company he had headed since 1943. He also becomes vice president and director of JCP&L . . . Sherman R. Knapp, president of Connecticut L&P, will act as chairman of PIP Steering Committee until a new chairman is selected to replace Henry B. Sargent who has resigned . . . Schuyler F. Baldwin, public relations director of Rochester G&E, has been elected chairman of PIP's Mid-Atlantic Regional Group.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Off the Washington Wire: Senate has passed public works appropriations bill (HR 6766, S 700) containing $1,377,491,000 for AEC, TVA, Engineers, and Interior power agencies. Included are several new starts on federal power projects not voted by House . . . House hearings begin this week on TVA bond financing bills . . . REA loans in fiscal 1955 totaled $167.5 million compared with $167.1 million previous year . . . Idaho Power has filed 34 exceptions to FPC examiner's report recommending the company be licensed to build only Brownlee Dam on Snake River. Firm said power shortage can only be averted by building both Brownlee and Oxbow projects, biggest of the three proposed by company.

Atomic Power: On basis of experience and experimental evidence British atomic power experts are assuming an operating life of 15 years for power reactors, J. A. Jukes, economic adviser, British Atomic Energy Authority, told annual convention of Canadian Electrical Association. Target for economic nuclear power, he added, is 7 mills per kwhr. Jukes said it is reasonable to assume an estimated average of 3,000-Mw-days per ton of nuclear fuel under operating conditions to be used. W. Kenneth Davis, director of AEC's Division of Reactor Development told meeting prospects for economic nuclear power continue to brighten but that we must expect some failures and disappointments.

Central P&L has disposed of its ice properties to Southern Texas Ice & Service leaving Central's business now completely electrical. In 1952, last full year of operation by Central, ice revenues amounted to about 8% of company's total.

Consolidated Edison Co of New York has signed contract with Babcock & Wilcox for what manufacturer claims will be largest boiler in world. It will produce 2.4 million lbs of steam per hour for Con Ed's Astoria station. Boiler will have design pressure of 2500 psi and will burn either coal, oil, or natural gas.

Grant County (Wash.) PUD has applied for FPC license to build $161-million, 620,000-kw dam at Priest Rapids on Columbia River . . . Ohio Edison has offered UWUA-CIO 6¼¢ an hour wage boost and other benefits. Union, which had threatened strike, will vote on offer . . . Duke Power has adopted bi-monthly billing.

ABOUT PEOPLE IN THE INDUSTRY

Walter T. Lucking, formerly vice president in charge of operations, has been elected president and director of Arizona PS to replace Henry B. Sargent who resigns August 1 to become president of American & Foreign Power. In announcing election of Lucking, Chairman M. O. Best said "We are convinced that he is fully qualified to continue our policy of providing adequate and dependable service to our customers at reasonable rates, and seeing that our employees and investors receive fair and proper treatment."

Preference clause giving public power groups first call on electric power generated at government-owned dams is discrimination of worst kind, according to Carl J. Forsberg, president, Wisconsin P&L. He said "In my opinion the policy of granting privileges to segregated groups of electric customers is un-American because the law does not take into consideration the fact that all taxpayers throughout the nation are being compelled to defray part of the power costs of a chosen few."

More News About People Page 193

Need for Dixon-Yates Plant Restudied

- **Eisenhower says he will cancel Dixon-Yates contract if Memphis builds plant**
- **While GOP sees "partnership" policy vindicated, Democrats claim a victory**
- **Budget Director Hughes's power study is expected to take about two weeks**

Last November when proponents of unlimited federal power expansion and their Democratic supporters had begun their game of political football with the Dixon-Yates contract, President Eisenhower set forth his power policy in a letter. He wrote to Rep W. Sterling Cole (R-N. Y.), then chairman of the Senate-House Atomic Energy Committee, saying, among other things:

". . . If the Federal Government assumes responsibility in perpetuity for providing the Tennessee Valley Authority area with all the power it can accept, generated by any means whatsoever, it has a similar responsibility with respect to every area and region and corner of the United States of America."

And a recent statement released by the White House said: "The President many months ago recommended that the City of Memphis develop its own power plant to supply the needs of the people of that area for electric energy. In the absence of any action by the city to accept this responsibility the federal government made the necessary plans to provide adequate power facilities for the Memphis area."

The President's determination to stand by this policy has borne some fruit. One of the favored areas, Memphis, is planning to build its own plant and stop accepting power from the federally-financed plants of TVA.

The Memphis decision not to lean on the federal government any longer removes a power drain from TVA which now can supply power needs of AEC.

Because of this, President Eisenhower also ordered a re-examination of the need of the Dixon-Yates steam generating plant which was to meet the needs of AEC.

The Dixon-Yates contract calls for a 600,000-kw, privately financed and built plant at West Memphis, Ark. The contract is in keeping with the Administration's determination to halt the seemingly unlimited expansion of TVA. Cancellation of the contract will require the government to pay expenses incurred to date but does not necessarily mean the construction of the plant will be suspended.

Edgar H. Dixon, president of Middle South Utilities, Inc, and Eugene A. Yates, chairman of Southern Co, the two firms which are to build the plant jointly, say that work on the plant is going ahead on schedule.

"We have a valid contract (with AEC) and will go ahead as if nothing had happened, aiming at our September, 1957 commitment," Dixon said.

WASHINGTON, D. C., McGraw-Hill News Bureau—The Dixon-Yates controversy rocked on last week, noisier than ever. Democrats and Republicans both are claiming a political victory.

Democrats hailed the success of their long drive to kill the power contract. Republicans didn't argue this point, but they claimed a victory for Eisenhower's partnership power philosophy by keeping TVA expansion off the federal budget.

Both factions have fought for a new power plant in the Memphis, Tenn., area. TVA wanted a new steam plant at nearby Fulton, Tenn. The Administration wanted new non-federal power, and negotiated the private Dixon-Yates proposal to build a 650,000-kw facility at West Memphis, Ark.

Then came the solution to both their problems: Memphis announced its intention to build its own 600,000-kw steam plant.

This fits in with Eisenhower's partnership idea. The question now is whether or not Memphis will follow through with its announced intention. The President's supporters say he certainly would not have ordered the restudy of the Dixon-Yates agreement—which was regarded as the first step toward cancellation — unless local power groups picked up the responsibility for meeting increased demand for power. Study is expected to take about two weeks to complete.

Eisenhower had repeatedly urged TVA-area cities to provide their own new power facilities. When his prodding seemed to have no effect, he had the Dixon-Yates contract signed.

That contract is still a binding legal document. The Dixon-Yates people have no choice except to live up to its provisions, and continue—slower, perhaps—their construction program, until cancellation becomes effective.

When and if that occurs is up to Memphis. President Eisenhower said flatly that he would cancel the contract if Memphis builds its plant.

The Senate tacked a rider on its fiscal 1956 TVA money bill giving Memphis 90 days to make good its promise to build the new plant. If the House goes along, the city will have three months to make a definite commitment. If it does, the Dixon-Yates contract may be cancelled, and the government will have to pay the estimated $2 million or so Dixon-Yates has spent so far in buying a plant site, clearing it, and placing orders for equipment.

If Memphis does not take definite action toward construction by the deadline date, the $6.5 million will be made available for construction of a TVA transmission line to cross the Mississippi River to connect with the Dixon-Yates plant. And, in this event, the Dixon-Yates plant will be built and the contract fulfilled.

If Memphis goes ahead as announced—and Memphis representatives in Washington swear the city will build—the new plant will become a part of the TVA complex. The city could build and operate it independently, but there would be many advantages to an integration contract. Probably four units would be installed, with the fourth unit's reserve capacity being pumped into the Valley system.

This arrangement would prove groundless the basic fears of TVA-area Democrats. The system they cherish would be provided with the additional capacity needed to forestall a power shortage. Since it would not cost the federal treasury a penny, the Administration's determination not to use federal money to expand TVA would also be fulfilled.

The needs of the AEC, government party to the Dixon-Yates contract, will be met. AEC signed the contract with the Dixon-Yates firm so that the private utilities' power could be pumped into TVA lines to replace the heavy power drain of AEC's Paducah, Ky., plant. Now that Memphis is planning to supply new power to this TVA service area, AEC's drain on TVA will not rise seriously.

One area will suffer, if the Dixon-Yates plant is abandoned. West Memphis, Ark., across the Mississippi River from Memphis, is growing as fast as the Tennessee community. The area is small in comparison, but it's having growing pains which could have been alleviated by receipt of 50,000 kw of Dixon-Yates' capacity through the system of Arkansas Power & Light Co, a subsidiary of one of the Dixon-Yates sponsoring companies.

Arkansas officials want a new power plant at West Memphis, but they were banking heavily on the Dixon-Yates facility, so they haven't studied the area's needs in light of the recent developments.

Those developments came fast. Within hours of each other, the following moves were made:

• Sen Estes Kefauver's (D-Tenn.) Senate judiciary subcommittee called Budget Bureau Director Rowland Hughes in for a hastily scheduled and unusual night hearing. Hughes had just completed a search of his Bureau's files to determine whether there was anything new to report on pre-Dixon-Yates conferences at the White House.

• Eisenhower ordered Hughes to keep Kefauver's investigators out of the Bureau's file rooms. Kefauver had demanded the right to send his men in for a personal check. He was looking for year-old references to meetings attended by Adolphe Wenzell, First Boston Corp, executive who had advised the Budget Bureau on Dixon-Yates financing. Eisenhower said he wouldn't let capitol hill investigators "wreck" the Bureau's files.

• The TVA board of directors adopted a resolution, the sense of which was that the Dixon-Yates plant was not needed in view of Memphis' promise to build its own plant. The TVA board, including Eisenhower's appointee, Chairman Herbert D. Vogel, found that Memphis' proposal would satisfy the area's need for more power, and that Dixon-Yates' power would be in surplus.

(*Continued on page* 84)

MEMPHIS TEAM—ALLEN AND TOBEY—CHECK PRESS REPORTS OF THEIR PLANS

Comments from Memphis

Frank T. Tobey, Mayor of Memphis, said that the City Commission had authorized the Memphis Light, Gas, & Water Department to proceed with planning and construction of a municipally owned electric plant.

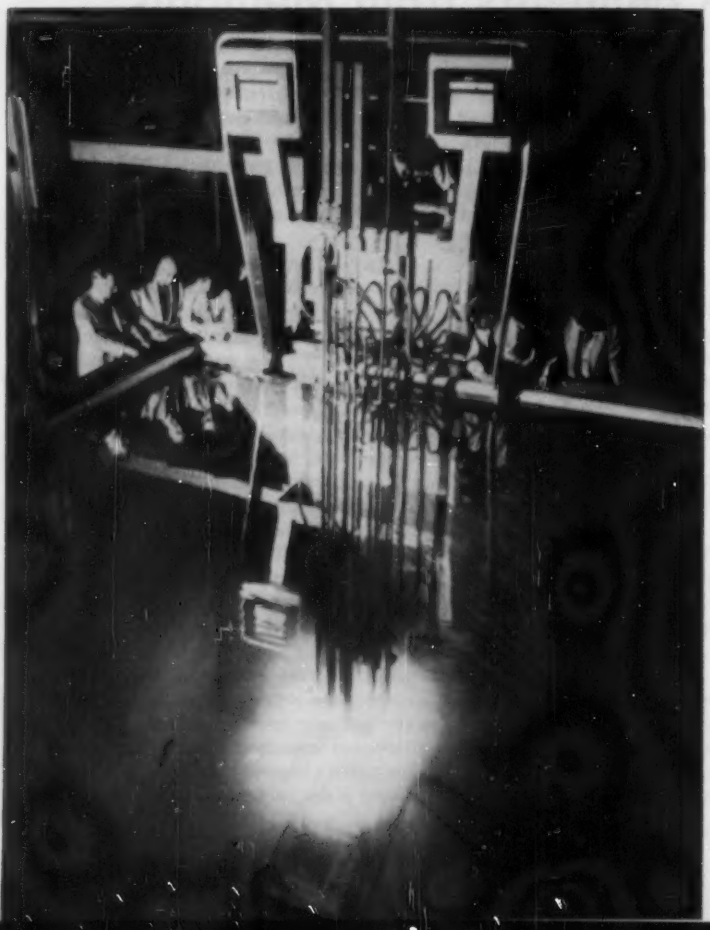
Prospective engineers, Tobey commented, are being interviewed to begin design of the plant. "We should have the firm hired within 30 days at the most, maybe within ten days," he declared. Commitment of the first $5 million in engineering fees ought to be sufficient to convince anybody that Memphis means business, he added.

Major Thomas H. Allen, president of the Memphis Light, Gas, & Water Department, is selecting a technically qualified engineering concern to make studies, plans, and specifications for the plant. He added that "we are talking with various financial institutions regarding the best method of financing this improvement." One of these, he pointed out, is a group headed by **Walter von Tresckow,** who said, "We are ready now, as we have been for some time, to design, construct, and finance the power plant for the City of Memphis."

On the question of rates on power produced by the proposed Memphis plant, Allen commented: Rates, with integration (into TVA's system), would be about the same; without integration, maybe slight increase.

Spokesmen for the City of Memphis attributed intense local opposition to the Dixon-Yates plant to a matter of money. The Memphis consumer, Allen said, who uses 400 kwhr a month pays $6.50. In Forrest City, Ark., 50 miles to the west, the same consumer would pay $11.54. Allen declared, "Sooner or later we would have to pay their (Arkansas) price."

Edgar Dixon and **E. A. Yates** said, "We have a valid binding contract and will go ahead as if nothing had happened, aiming at our September, 1957 commitment date. We have never had any contractual arrangement with anyone other than the AEC. We have not considered what we will do if our contract with AEC is cancelled. We haven't crossed that bridge yet. We still have a contract and we are continuing plans on that basis."



U. S. Atom

The U. S. has been going all out in preparation for the big United Nations' atoms-for-peace conference, August 8-20, in Geneva, Switzerland, where East and West will vie with each other in presenting evidence of atomic progress.

A dress rehearsal for the U. S. act was staged recently in a waterfront warehouse in Alexandria, Va., across the Potomac River from Washington, and in the Atomic Energy Commission's layout at Oak Ridge, Tenn.

With a six-foot model (see pictures at top right) as guide, workmen in the Alexandria warehouse erected the complete floor exhibit occupying 4,000 sq ft. And the full-scale operating "swimming pool type" reactor to be displayed was put into test operation at Oak Ridge (see bottom left picture).

Both the reactor and the floor exhibit were to be disassembled, crated in parts, and shipped to Geneva for reconstruction. Slated for emphasis at the atom show is the nation's nuclear progress in industry biology, medicine, and agriculture.

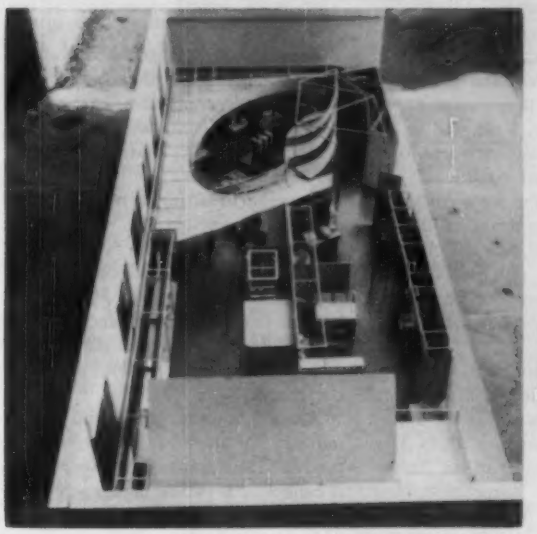
Miniature reactors on display at the exhibit will include models of all five designs in AEC's five-year plan—the pressurized water or PWR (see pictures at lower right), the breeder, the sodium graphite, boiling water, and homogenous reactors.

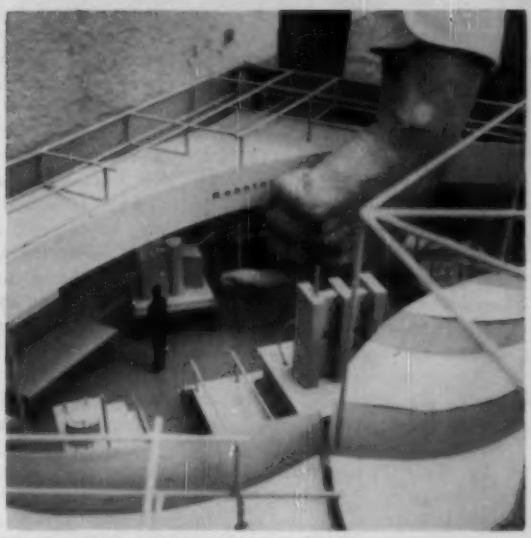
Other reactors scheduled for pint-size display are Argonne's Borax and its materials testing plant; the Consolidated Edison Co of New York, Inc, modified PWR; and Detroit Edison Co's breeder. Layouts will be presented of Nuclear Power Group's boiler reactor, Consumers PUD's sodium-graphite, and Yankee Atomic Electric Co's PWR.

In addition to the full-scale reactor and the floor exhibit with its reactor models, example of U.S.-made instruments, pictures, diagrams, and

"SWIMMING POOL" REACTOR for display by the U. S. at the Geneva atoms-for-peace conference is shown at left illuminated by the fuel elements at the bottom of the 19-foot-deep pool. Constructed by the Atomic Energy Commission at Oak Ridge, the reactor was scheduled to be disassembled, crated, and shipped to the United Nation's Conference site. After the conference, the reactor will be sold to Switzerland.

Gets Dressed Up for Geneva Show





SCALE MODEL, SIX FT LONG, GUIDES IN SET UP OF U. S. EXHIBIT-HALL DISPLAY

PRESSURIZED WATER REACTOR IS ONE OF EIGHT MINIATURE PILES TO BE SHOWN

art panels, 600 to 700 papers will be presented. And across-town from the main show, the U.S. Information Agency's Europe-touring atoms-for-peace exhibit will be set up.

President Eisenhower instigated the big U.N. show more than a year ago with his now famous atoms-for-peace offer. The Geneva Conference, as a result, was arranged to uncover ways to establish a U.N. agency devoted exclusively to peacetime uses of the atom and to discuss methods of carrying out its program. The Russian's have not joined the agency, but, officially, the U.S. still hopes they will.

Communist nations have been invited to Geneva and all are expected to attend, except for those states such as North Korea whose legal status is disputed internationally.

A domestic strain, resulting from plans for the big show, has centered around the bluntness with which AEC and State Department officials have rebuffed American businessmen who wanted to share the exhibit hall. Although almost 100 U.S. firms will participate as AEC subcontractors, none will have an exhibit of its own endorsed by the government.

The upshot is that private U.S. exhibitors have made their own arrangements with Swiss businessmen, chiefly with the Swiss Automobile Club, which operates the biggest (270,000 sq ft) hall in Geneva, or they have dealt through U.S. entrepreneurs who tied up thousands of feet of display space in the town. As a result, there won't be as many private U.S. exhibits as there might have been.

Harriman Okays Revised Alcoa Contract

The hassle which split New York State public power forces over Aluminum Corp of America's proposed contract for St. Lawrence River power, now being developed, lost some of its fire recently when Gov Averill Harriman announced his approval of modified contract terms.

The revised contract reduces the maximum term from 48 to 43 years and provides that the state can cut its power allocated to Alcoa in half after 33 years. It also eliminates a controversial clause which stated that, in case of a strike or a lockout, Alcoa would have to pay only 50% of the price of the power for which the company had contracted.

The original contract was approved by the State Power Authority but drew fire from Democratic Senator Herbert H. Lehman. He had attacked it as a "giveaway" of New York State's natural resources.

Of the revised terms, Senator Lehman said, "The contract in its present form, while not ideal and altogether satisfactory from the viewpoint of public power policy, I am glad to say represents a vast improvement over the former proposed contracts."

Both Alcoa and the State Authority also have voiced approval of the revised contract which, like the original, permits Alcoa to purchase for its Massena plant about one-quarter of the U. S. power to be developed from the St. Lawrence.

Although the principles involved favored the modified contract, two public power groups continued to flay away at the arrangements. Both Alex Radin, general manager of the American Public Power Association, and Robert Donovan, manager of the Rural Electric Co-operatives of New York State, issued statements in opposition.

They declared that the modifications failed to overcome the basic objections. The contract term was still too long and Alcoa still would receive too much of the St. Lawrence power, they said.

Governor Harriman replied, "The aluminum company has operated at Massena for more than 50 years and anyone who would use the development of St. Lawrence power to drive it from this area would render a profound disservice to the entire state and to the cause of public power in our country."

Alcoa's Massena plant, the largest industry in the area, employs 6,500 people. The company has stated that it cannot continue to operate its plant unless it has an assured long-range power supply.

Rail-Mounted Plant To Ease Shortage

MEXICO CITY (McGraw-Hill World News)—A rail-mounted gas turbine power plant will be acquired by the Mexcian Federal Power Commission early next year to help relieve the acute power shortage in the drought-stricken Guadalajara zone.

The plant, with a capacity of 6,200 kw, will be built by Clark Bros Co, Olean, New York, one of the Dresser Industries.

The first such plant (EW, Feb. 22, 1954, p 108), also constructed by Clark Bros, will be three years in the making. It is expected to be delivered to the U. S. Navy sometime this fall. The Mexican Power Commission's plant will follow specifications similar to the first unit.

The Mexican plant will be mounted on a specially built railroad car of standard width and 86 ft long. No. 2 diesel oil and natural gas can be used as fuel. And no water is required for the plant. The lack of water in western Mexico has created a severe power shortage in Guadalajara for the past few months.

Although the total cost of the new plant has not been disclosed, it was reported that the entire plant, including the special railroad car, will cost less than $150 per kw.

The unit, largest two-shaft gas turbine power plant in Latin America to be mounted on a single railway car, has been so designed that it can be pulled by a passenger train locomotive and will travel up to speeds of 60 mph.

Dixon-Yates

(*Continued from page* 81)

• Eisenhower was called off the Burning Tree Golf Course, just outside Washington, when the TVA resolution was received. He immediately ordered Hughes to make a restudy of the Dixon-Yates contract to determine whether the West Memphis plant was needed.

• Hughes and his staff worked through the July 4th weekend studying the contract, the appropriations fight, the Memphis announcement, the TVA resolution, and AEC's and TVA's power needs. They met with officials of both federal agencies and those of the Dixon-Yates firm. Their findings: The contract should be cancelled—when and if Memphis begins to build its plant. The government should pay all expenses incurred by Dixon-Yates. If Memphis doesn't begin to build within three months, Dixon-Yates should move forward, and the TVA transmission line built to forestall the power shortage which threatens this industrial area.

• Consideration of Dixon-Yates' financing by the Securities and Exchange Commission hung fire. SEC has been asked to approve the company's plan to borrow about $100 million from a group of banks and insurance companies to augment the $5.5 million in equity capital put up by the sponsoring companies.

The commission has concluded hearings, and a quick decision had been expected until the President called for a restudy of the situation. Obviously, SEC will await the outcome of the political hassle before it takes any further action.

This brings up a point in regard to the contract itself. When it approved the equity financing plans of the firm, SEC ruled that the two sponsoring holding companies should be permitted to join in creating an operating utility because the new utility's load would be used for national defense purposes—supplying, indirectly, the AEC's needs at Paducah, Ky.

If Memphis builds its plant, then the two companies have to start all over again on the problem of supplying their own service areas with power needed in the future. The Dixon-Yates arrangements no longer would apply.

March of Dams

A "Parade of Dams" was staged recently by the Army Corps of Engineers with the dedication of three Northwest dams in as many days. George H. Roderick, assistant secretary of the Army for civil works, officiated at all three ceremonies.

The dams on parade—Lucky Peak, Albeni Falls, and Lookout Point with its re-regulator, Dexter Dam—represent an expenditure of $140 million and total generation capacity of 177,600 kw.

Lucky Peak Dam, a $19.3-million flood-control structure astride the Boise River near Boise, Idaho, led off the parade. It has no power facilities; however, provisions have been made for future generation.

Albeni Falls Dam, on the Pend Oreille River between Priest River, Idaho, and Newport, Wash., cost $31 million. It will generate 42,600 kw when its third 14,200-kw generator goes on the line. Its second unit was spun into operation as part of the dedication ceremonies.

Idaho's Gov Robert E. Smylie at Albeni Falls presented a special plaque in recognition of a safety record which Army Engineers believe to be unequaled in the construction industry. The dam, requiring 2.5 million man-hours to build, was completed without a single fatality.

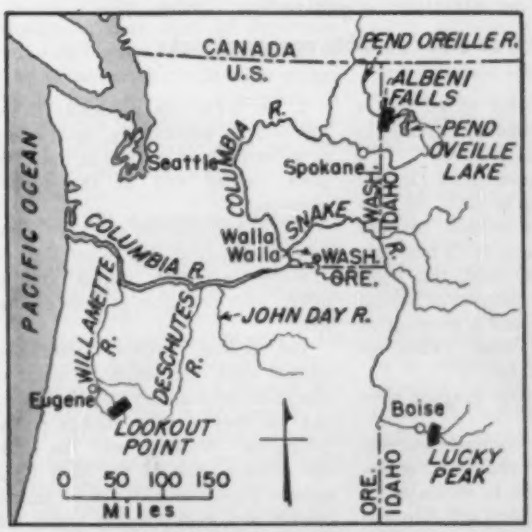
Lookout Point Project was the most impressive performer. Including Dexter, the re-regulating unit, the project cost $89 million and will produce 135,000 kw of electric energy.

Ceremonies at the Lookout Point location, 23 miles southeast of Eugene, Ore., on the middle fork of the Willamette River, included a program of band music, water ski demonstrations, an array of 40 boats from the Eugene Yacht Club, and jet fighter planes screaming overhead in formation flights.

With the completion of the three dams, the $422-million multipurpose Willamette Basin project was considered about 45% complete.

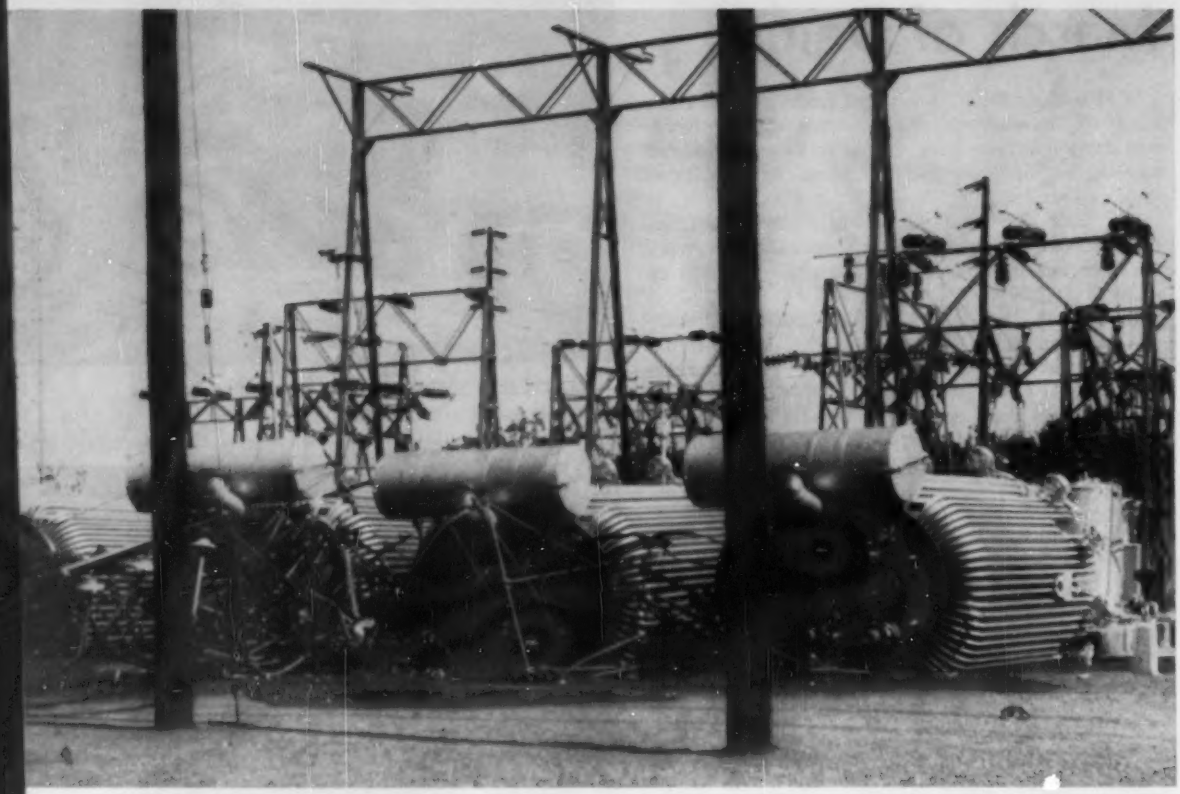
LUCKY PEAK DAM

ALBENI FALLS DAM



PARADE COVERED THREE STATES

LOOKOUT POINT DAM



EXPERIENCE with earthquake damage, above, and other natural disasters, has equipped California utilities to prepare efficient statewide plan to cope with extreme emergencies such as might follow atom bomb attack (see opposite)

MANAGEMENT—Public Relations

Coast Utilities Set for Emergencies

California utilities have established an efficient organization, within the framework of state's disaster relief plan, to meet possible enemy attacks

HOMER G. KEESLING, Utilities Coordinator, Office of Civil Defense, State of California, San Francisco, Calif.

Should an enemy force attack the United States tomorrow, there is at least one state where the utilities have an organization ready to cope with the worst.

The organization in California is part of the state's overall disaster and relief plan, it has been drawn up by the utilities themselves. Furthermore, this is not merely a paper plan. Operating points have been established, personnel at the various levels have been appointed and their tasks assigned, and the organization could go into operation at a moment's notice.

This plan, which conceivably could be a model for other states, makes utmost use of experience of utilities in coping with natural disasters.

When the California Civil Defense Program was set up in 1950, the governor appointed a utilities advisory committee. Consisting of 19 men representing the utility field, this committee developed a program of mutual aid among utilities and a program of cooperation with other Office of Civil Defense agencies.

The objectives of the program were threefold:

1. To integrate, coordinate and correlate the utilities' resources, equipment, and manpower to obtain maximum benefit from local self-help and mutual aid.

2. To define the procedure to be followed in maintaining, establishing or re-establishing services at time and place needed and in the proper amounts.

3. To delineate the extent of manpower, equipment, and material pools available to relieve distress, and to utilize such resources in case of disaster.

The utilities advisory committee quickly went into action. It assigned nine men representing electric, water, and gas utilities to a utilities policy committee. Working with the utilities division chief of the State Civil defense organization, it played an important part in developing Annex 4-c of the California State Civil Defense

and Disaster Relief Plan. Annex 4-c outlines the organization and general procedures to be followed in operating water, gas and electric utilities under disaster conditions.

In studying and developing the disaster preparedness program, the utilities policy committee found it necessary to employ a small staff to activate and coordinate the program effectively.

Legal restrictions prohibited the publicly and privately-owned utilities from entering into a joint venture agreement to cover this proposed program. So an agreement was developed and entered into by a number of publicly owned utilities with the understanding that the privately owned utilities would contribute and participate on a voluntary basis. Any utility, whose participation is purely voluntary, can withdraw, if it desires, at the end of one year. Annual contributions to the program are based upon the utility's gross revenue. At present, 91 utilities are participating in the program.

Coordinator Develops Plans . . . Out of available funds, a utilities coordinator was employed. He attended meetings and hearings on utility service and supply during emergencies. He also accumulated information relating to facilities, source of supply, materials, equipment and personnel engaged in serving the utilities. While he was developing plans for the orderly and effective interchange of water, gas, and electrical energy during emergencies, he also assisted the utilities division chief in developing an overall program among the utilities and in cooperating with other phases of the state civil defense program. It was his task to inform utilities of proposed legislation and other developments of interest to them.

Mutual Aid Agreements Made . . . Utility planning has always taken into consideration the need for meeting disasters due to weather, earthquake, fire, or flood. Men, materials, and equipment have been furnished for relief of a troubled area by a neighboring area, less affected, through mutual aid programs many times in the past. With this experience, mutual aid agreements were reached easily among the utilitiy companies.

The picture then shapes up like this: The Office of Civil Defense is comprised of 15 divisions, and is headed by a director with offices in Sacramento. The state is divided into ten regions. Each region has a coordinator, administrative personnel, and volunteer service chiefs. These chiefs represent local agencies, including the electric, gas, and water utilities. Each region has a control center with "bell and light" alarm system for receiving "alert" signals.

ATOM BOMB attack could bring destruction such as this which resulted in the recent tests in Nevada. California plan is ready to meet such a situation

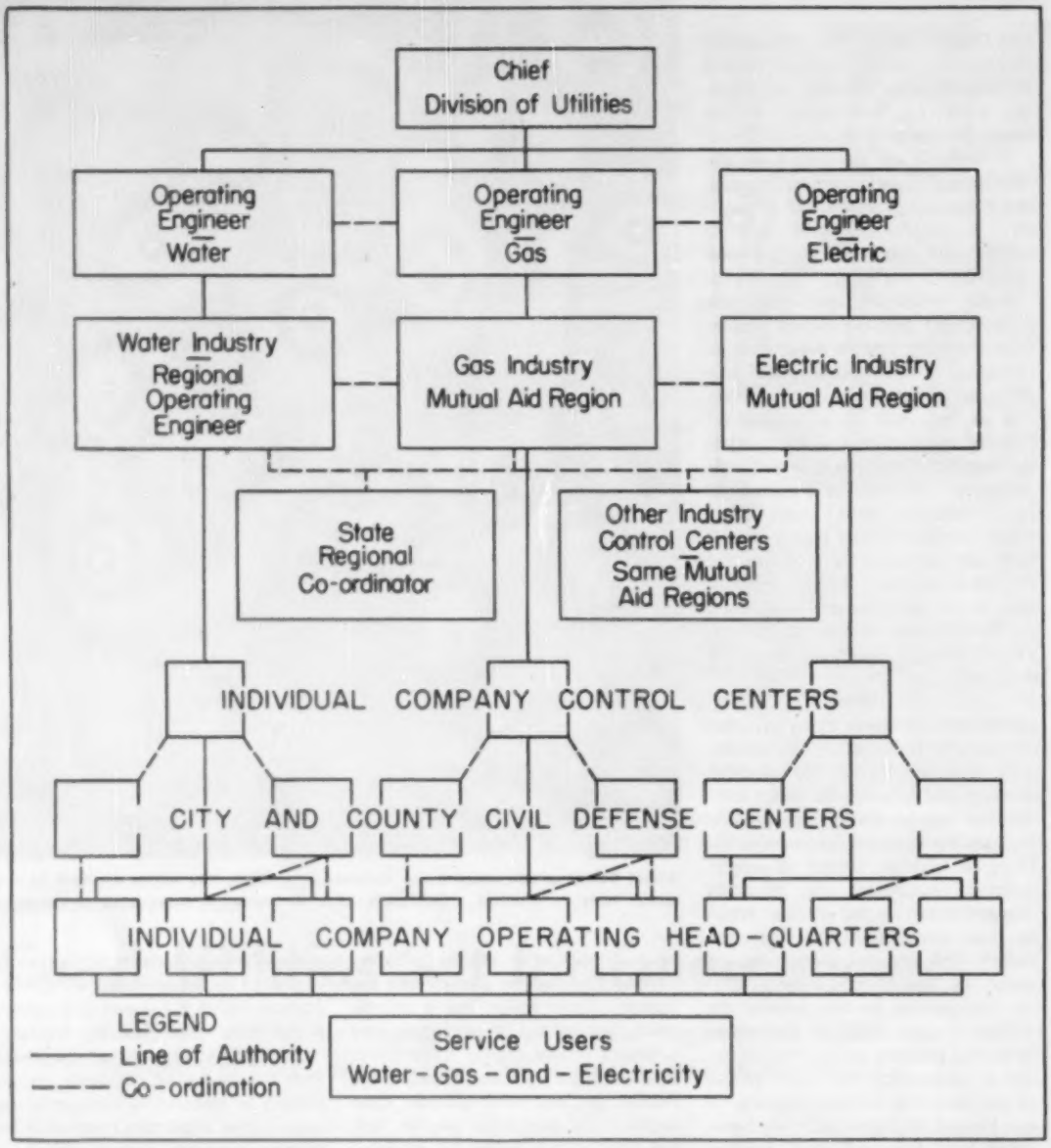
The utilities division chief reports to the state director. The chief or one of his alternates, all of whom are experienced operating men, assumes the responsibility for all utility operations throughout the state.

Each utility industry is coordinated by an operating engineer who is responsible for his respective group of utilities throughout the state. Electric and gas systems usually are operated statewide while water systems, generally covering less territory and having few interconnections, are operated separately. Because of their smaller operation units, each of the state's ten regions has a regional water operating engineer. He is responsible for the operations within his region and reports to the state water operating engineer.

Each utility has prepared and placed with the operating engineers an inventory of material for emergency use and a list of employees essential in an emergency. Their business and home telephone numbers are included, along with other means of communication, such as utility lines, carrier systems, and radio. Also listed, are facilities provided by the state upon which utilities have high priority.

To maintain perfect understanding and cooperation between the utilities and other disaster agencies, the utilities have a staff in the state OCD building. This staff works closely with all of the other OCD divisions.

Identical operations will be conducted in all three utility groups. Following a state-of-extreme-emergency declaration, the state electric operating engineer (SEOE) will assume



ORGANIZATION CHART shows how California's utilities are set up within state's overall civil defense and disaster relief plan. Organization is complete and includes assignment of personnel, officials, and numerous alternates

complete responsibility for the program of the electric utilities.

He will notify all alternate SEOE's of his location and telephone number. After ascertaining the location and extent of damage, and what assistance is needed, he will supervise whatever aid is requested. While assisting and directing the purposes and objectives stated in Annex 4-c, he will keep the utilities division chief informed.

Each utility has interconnections with neighboring utilities and contracts cover the sale or interchange of electric power and energy. After the SEOE determines which utilities will help those in distress, the utilities will deal directly with each other.

Utilities will use available contractors before calling on other utilities for help. It is the duty of the receiving utility to determine the route and make provision to get crews through police lines in its area. It will arrange for food and lodging and assist the supervisor in charge in all possible ways.

Food and lodging is paid for by the receiving utility. Each crew, however, will be paid by its own company at its regular rates and will work under its company's safety rules.

Utilities will obtain as much material, supplies, and work equipment from their regular suppliers as possible before calling on other utilities. When help is needed, the SEOE will be informed and will decide which neighboring utility will assist.

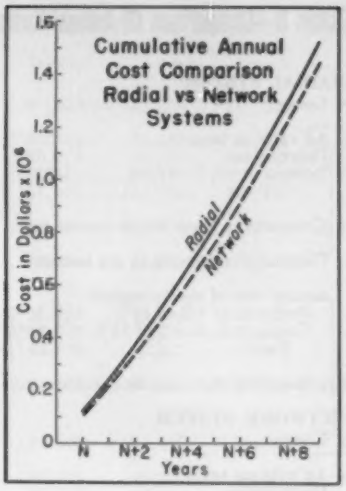


FIG 1—ANNUAL COSTS of network and radial systems are compared

FIG 2—RADIAL SYSTEM total construction cost below network's

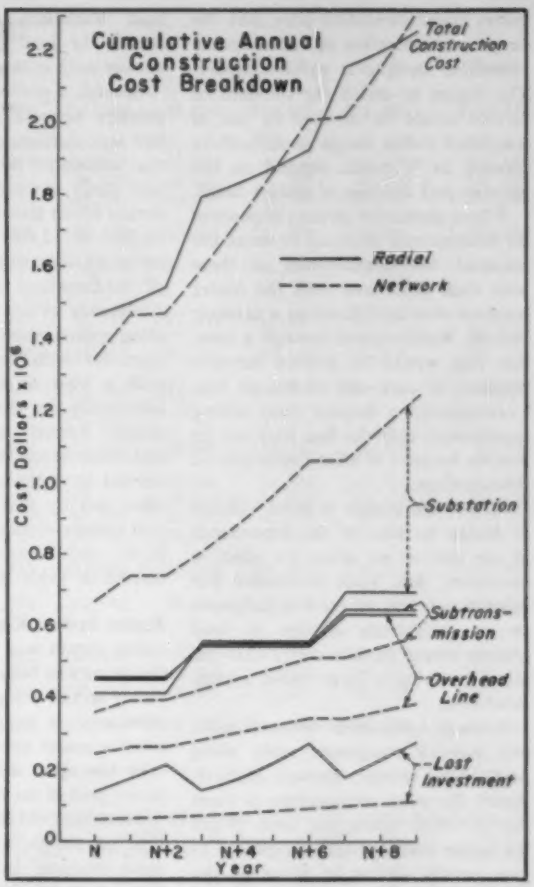


Table I—How The Costs Compare

	Radial	Network
Accumulated Annual Cost	$1,530,638	$1,451,031
Net Investment Cost	1,761,580	1,837,710
Construction Cost	2,261,022	2,318,923

The accumulated annual cost is based on fixed charges of 15.5% applied to the investment for each year of the period in addition to losses evaluated at $32 per kw per year.

The net investment represents the installed property cost less depreciation reserve.

The construction costs represent actual construction expenditures plus an allowance for distribution losses capitalized at $150/kw.

Network Distribution Costs Less

Indianapolis P&L study shows network system in 1,500 to 10,000-kva-per-sq-mile density area saves $79,607 over a radial system in a ten-year period

R. P. HUBER, Engineer, Indianapolis Power & Light Co, Indianapolis, Ind.

A network distribution system today costs less annually than a radial system for serving a medium-load-density area at a satisfactory level of service continuity. Indianapolis Power & Light Co arrived at this conclusion from its recent study of its own system, employing 34.5 kv for subtransmission and 4 kv for distribution. Medium load density was assumed to be between 1,500 and 10,000 kva per sq mile, a load classification fitting most of the utility's present urban load.

Total net property investment and total construction costs are lower for the radial system, as shown in Table I. The net investment represents the installed property cost less depreciation reserve; construction costs, actual construction outlays plus distribution losses capitalized at $150 per kw.

Network Annual Charges Lower . . . The accumulated annual charges, however, are lower for the network system, also shown in Table I, because of the installation of equipment in smaller increments. Such installation obviates the payment of fixed charges on unused property over a period of years, such payments being inherent in large radial unit design.

Designs for both systems at the final loading used in the study make use of all the capacity of installed equipment. This implies that either design will call for additional capacity each year over an extended period. But in the network design, any substation or feeder breaker can be taken out of service at any time for maintenance without requiring the installation of additional equipment to carry the load. Faults on the overhead line, where the line is burned open and the fault cleared, do not drop load on the network system whose line is served from both ends. In the radial design any load beyond the point of fault is dropped until emergency switching can be completed.

Radial System Advantages . . . The radial-type distribution system re-

quires fewer substation sites, and the design and operation of radial system protective devices is much simplier. The degree to which the standard of service would be lowered by use of simplified radial design is difficult to foresee, as it would depend on the number and location of system faults.

Where protective devices dependent on time-current relations in series are required, the coordination of these with each other and with the feeder breakers may be difficult on a network system. Fault current through a spur-line fuse would be divided between breakers at each end of the tie line. Consequently, a breaker relay setting coordinated with the fuse may not be feasible because of other limitations on these settings.

A network system is more difficult to design because of the dependence of one unit on the others for effective operation. But, since investment per substation is less, an error in judgment or an unforeseen change in load growth would be less costly than an error involving a large radial system substation.

A rough comparison between radial and network equipment costs, using 34.5/13-kv ratings, showed approximately the same relationships as when the 34.5/4-kv rating was used. While the higher voltage may be expected to give results similar to those of the utility's study, this matter needs further exploration.

In a design based on 138/13 kv, the radial system would be expected to be the most economical for the Indianapolis Power & Light system. Radial design permits use of the large substations on the existing 138-kv ring to take advantage of 138-kv facilities available. The impracticability of routing 138-kv lines along city streets also limits the use of the network type design, as many more locations to be served by these transmission lines would be required.

Two Approaches . . . Two approaches were made to the cost problem. First, a theoretical study was made of one circuit of each of the two system designs, assuming a maximum circuit load limitation of 2,000 kva and a uniform load density of 5,000 kva per sq mile. It showed that the network design has an annual cost approximately $1,900 less than the radial design. This difference amounts to about 9.8% of the total annual cost estimated for serving the 2,000-kva load. Variations in circuit load limitations, or load densities, effect the answer only in degree.

Second, a portion of the north 4-kv primary network section of the system was studied, using the conditions that influenced its design. This practical study covered a ten-year period during which initial loading grew from 26,000 to 52,000 kva. This section serves an area which is representative of medium-load density, being predominately urban residential and covering approximately 7.7 sq miles. Designs for both systems were set up with a view to supplying this load adequately in the initial and final stages. Annual cost, investment cost, and construction cost figures were calculated in order to compare the systems year by year. The accumulated cost comparisons are shown in Tables II, III, and IV, and the terms used are defined in Table II.

Radial System Kept Simple . . . The radial system was held to as simple a design as was believed capable of providing service comparable with present standards. It required reserve equipment to assure minimum outage of the 4-kv bus upon occurrence of trouble in any part of the source system.

Maximum circuit loadings for each type of design were limited to the same amount. In each case voltage drops were limited to a maximum of 3% in any primary line section with voltage regulators limited to one set for any main line run.

Quality of Service . . . In the theoretical study, a load area was assumed to be served by either a tie circuit between two network substations, or by a radial circuit out of a radial substation. The annual cost of serving this load was then calculated, using the portion of the substation cost that would be chargeable to the one circuit.

In the practical study, designs for the two types of distribution systems were laid out to serve a portion of the present north 4-kv primary network section. Annual costs, net property investment cost, and construction costs were computed for each system for a ten-year period, which allowed the initial load to double.

Both studies revealed that the network distribution system is the more economical for a comparable quality of service and the conditions that were assumed.

(*Continued on page* 204)

Table II—Comparison Of Annual Costs

RADIAL SYSTEM

Losses

Ad valorem taxes 3.0%
Depreciation 2.75%
Interest at 3¾% of 50% 1.875%
Total

Comparative Costs before income tax

Comparative decrease in net income

Annual cost of equity capital:
Preferred at 5% of 16% 0.80%
Common at 10.6% of 34% 3.60%
Total

Comparative decrease in earnings

NETWORK SYSTEM

Losses

Ad valorem taxes
Depreciation
Interest (Bonds)
Total

Comparative cost before income tax

Comparative decrease in net income

Annual cost of equity capital:
Preferred
Common
Total

Comparative decrease in earnings

Table III—Comparison Of Net Profit

RADIAL SYSTEM

Property—beginning of period
Additions
Property—end of period
Depreciation reserve—start of period
Add. Provisions @ 2.75%
Depreciation reserve—end of period

Net property—end of period

NETWORK SYSTEM

Property—beginning of period
Additions
Property—end of period
Depreciation reserve—start of period
Add. Provisions @ 2.75%
Depreciation reserve—end of period

Net property—end of period

Table IV—Comparison Of Construction

RADIAL SYSTEM

Overhead line
Substations
33 KV Subtransmission

Total

Loss investment

Total Construction

NETWORK SYSTEM

Overhead line
Substations
33 KV Subtransmission

Total

Loss investment

Total Construction

Note: * Reductions

For North Area For Radial And Network Distribution Systems

Year n	n+1	n+2	n+3	n+4	n+5	n+6	n+7	n+8	n+9	Total
$7,300	$9,080	$11,320	$7,400	$9,210	$11,480	$14,280	$9,360	$11,680	$14,520	$105,630
43,938	43,938	44,974	46,255	53,852	54,899	56,201	57,821	64,845	66,177	532,900
40,277	40,751	41,813	45,882	49,844	50,921	52,260	56,222	60,052	61,420	499,442
27,461	28,109	28,909	33,658	34,312	35,126	36,138	40,528	41,361	42,394	347,996
111,676	112,798	115,696	125,795	138,008	140,946	144,599	154,571	166,258	169,991	1,380,338
118,976	121,878	127,016	133,195	147,218	152,426	158,879	163,931	177,938	184,511	1,485,968
57,108	58,501	60,968	63,934	70,665	73,164	76,262	78,687	85,410	88,565	713,264
11,717	11,993	12,335	14,361	$14,640	14,987	15,419	17,292	17,647	18,088	148,479
52,785	54,029	55,568	64,694	65,952	67,516	69,462	77,901	79,501	81,487	668,895
64,502	66,022	67,903	79,055	80,592	82,503	84,881	95,193	97,148	99,575	817,374
$121,610	$124,523	$128,871	$142,989	151,257	155,667	161,143	173,880	182,558	188,140	1,530,638
$3,220	$3,440	$3,665	$3,910	$4,170	$4,450	$4,750	$5,070	$5,410	$5,800	43,885
40,253	40,253	43,978	44,113	47,856	51,607	56,031	60,462	60,648	65,100	510,301
36,898	38,606	40,375	42,153	45,588	49,336	53,392	55,509	57,634	61,722	481,213
25,158	27,486	27,570	29,910	32,255	35,020	37,789	37,905	40,687	43,479	337,259
102,309	106,345	111,923	116,176	125,699	135,963	147,212	153,876	158,969	170,301	1,328,773
105,529	109,785	115,588	120,086	129,869	140,413	151,962	158,946	164,379	176,101	1,372,658
50,654	52,697	55,482	57,641	62,337	67,398	72,942	76,294	78,902	84,528	658,875
10,734	11,727	11,763	12,761	13,762	14,942	16,123	16,172	17,360	18,551	143,895
48,357	52,832	52,995	57,492	61,999	67,312	72,635	72,859	78,207	83,573	648,261
59,091	64,559	64,758	70,253	75,761	82,254	88,758	89,031	95,567	102,124	792,156
$109,745	$117,256	$120,240	$127,894	$138,098	$149,652	$161,700	$165,325	$174,469	$186,652	$1,451,031

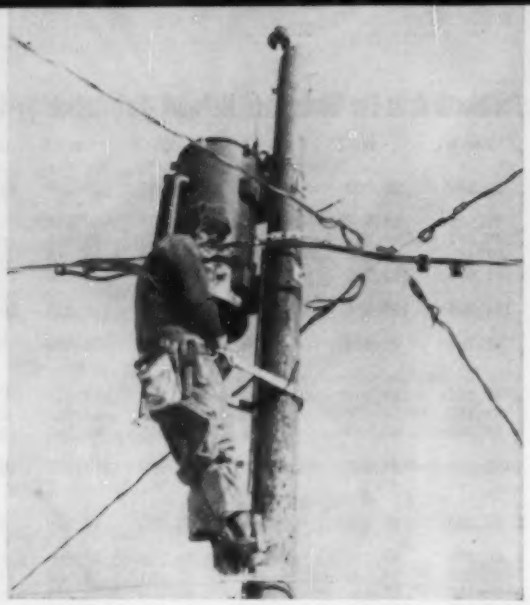
For Radial And Network Distribution Systems For North Area

$1,464,610	$1,464,610	$1,499,135	$1,541,835	$1,795,068	$1,829,968	$1,873,368	$1,927,368	$2,161,502	$2,205,902	$1,464,610
.....	34,525	42,700	253,233	34,900	43,400	54,000	234,134	44,400	55,120	796,412
1,464,610	1,499,135	1,541,835	1,795,068	1,829,968	1,873,368	1,927,368	2,161,502	2,205,902	2,261,022	2,261,022
.....	40,277	81,028	122,841	168,723	218,567	269,488	321,748	377,970	438,022	.....
40,277	40,751	41,813	45,882	49,844	50,921	52,260	56,222	60,052	61,420	499,442
40,277	81,028	122,841	168,723	218,567	269,488	321,748	377,970	438,022	499,442	499,442
$1,424,333	$1,418,107	$1,418,994	$1,626,345	$1,611,401	$1,603,880	$1,605,620	$1,783,532	$1,767,880	$1,761,580	$1,761,580
$1,341,776	$1,341,776	$1,465,953	$1,470,453	$1,595,230	$1,720,307	$1,867,711	$2,015,415	$2,021,615	$2,170,019	$1,341,776
.....	124,177	4,500	124,777	125,077	147,404	147,704	6,200	148,404	148,904	977,147
1,341,776	1,465,953	1,470,453	1,595,230	1,720,307	1,867,711	2,015,415	2,021,615	2,170,019	2,318,923	2,318,923
.....	36,898	75,504	115,879	158,032	203,620	252,956	306,348	361,857	419,491	.....
36,898	38,606	40,375	42,153	45,588	49,336	53,392	55,509	57,634	61,722	481,213
36,898	75,504	115,879	158,032	203,620	252,956	306,348	361,857	419,491	481,213	481,213
$1,304,878	$1,390,449	$1,354,574	$1,337,198	$1,516,687	$1,614,755	$1,709,067	$1,659,758	$1,750,528	$1,837,710	$1,837,710

Required To Service North Area With Radial Or Network Distribution System

$454,701	.....	.....	$89,182	.....	.....	.....	$89,183	.....	.....	$633,066
417,234	.....	.....	140,651	.....	.....	.....	140,651	.....	.....	698,536
452,400	.....	.....	98,700	.....	.....	.....	98,700	.....	.....	649,800
1,324,335	.....	.....	328,533	.....	.....	.....	328,534	.....	.....	1,981,402
140,275	$34,525	$42,700	* 75,300	$34,900	$43,400	$54,000	* 79,400	$44,400	$55,120	279,620
$1,464,610	$34,525	$42,700	$253,233	$34,900	$43,400	$54,000	$234,134	$44,400	$55,120	$2,261,022
$246,500	$20,071	.....	$20,071	$20,071	$20,071	$20,071	.....	$20,071	$20,071	$386,997
670,516	69,937	.....	69,937	69,937	91,864	91,864	.....	91,864	91,864	1,247,783
362,860	29,969	.....	29,969	29,969	29,969	29,969	.....	29,969	29,969	572,643
1,279,876	119,977	.....	119,977	119,977	141,904	141,904	.....	141,904	141,904	2,207,423
61,900	4,200	$4,500	4,800	5,100	5,500	5,800	$6,200	6,500	7,000	111,500
$1,341,776	$124,177	$4,500	$124,777	$125,077	$147,404	$147,704	$6,200	$148,404	$148,904	$2,318,923

AERIAL CABLE secondary system costs slightly more than an open-wire system but offers improved service reliability



CONNECTIONS USED with this design eliminate service attachments to pole. Allows more working space for lineman

DISTRIBUTION—Design

New Design for Secondary System

Here are some of the advantages:

- **Improved safety, pole clear of obstructions**
- **Connection at pole uses only 1¾ in. of space**
- **Installed in ⅓ time of conventional system**
- **Better resistance to tree troubles and storms**
- **Less maintenance and pole replacement costs**

F. T. HAUSLE, Distribution Design Engineer, Long Island Lighting Co, Garden City, N. Y.

Development of a connection system specifically for aerial cable has helped Long Island Lighting Co to design a better self-supporting aerial cable secondary system. The scheme uses ordinary twisted triplex and quadruplex copper or aluminum cable with a 600-v Neoprene insulation on the live legs and a bare-neutral conductor as the supporting member. This newly designed system avoids the use of pigtails taped to the triplex secondary mains or a bus arrangement at the pole where secondary is spread out to conventional spacing.

Basic Requirements . . . Trial installation was designed on the premise that an aerial cable secondary system should have the following characteristics:

1. Aerial cable secondary should support its services within reaching distance of the pole or, where necessary, in mid-span thereby leaving the pole free of service attachments. This would provide a safer pole for future maintenance and operational work by allowing free climbing and working space.

2. Aerial cable neutral in combination with the neutral connection should provide an adequate service support as well as a good electrical connection.

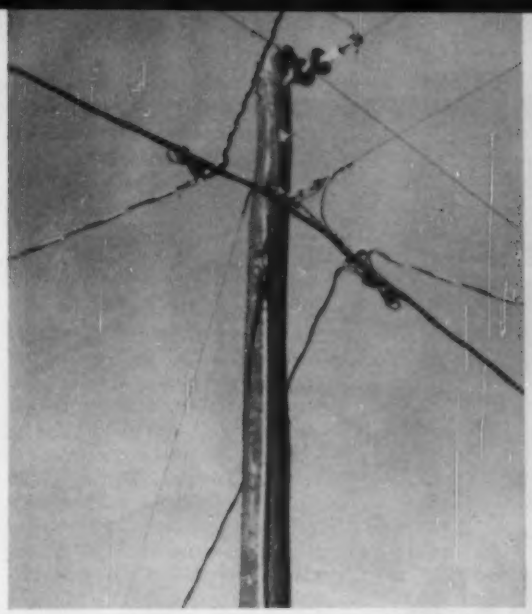
3. Type of live line connector used should have a prefabricated insulating cover. This would eliminate taping a secondary cable connection and allow individual addition or removal of any service connected to the cable.

4. Aerial cable attachment to the pole should occupy a minimum of space.

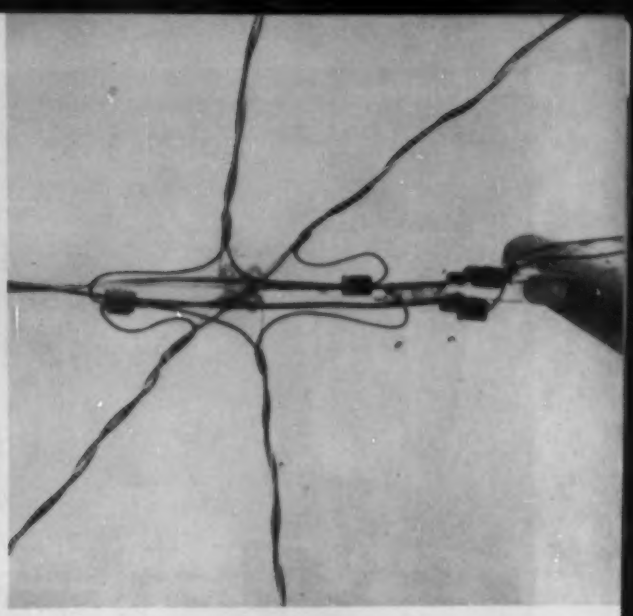
In comparing the significant characteristics of the final aerial cable desgin with those of the conventional open-wire secondary system, the overall advantages obtained far outweigh the small cost differential in favor of the conventional open-wire secondary system.

Advantages in favor of the twisted aerial cable secondary system are:

Improved Safety . . . Because this design eliminates service attachments to the pole, the pole is clear of any obstructions which would interfere with climbing, hot stick work, or equipment installation or removal. In addition, where pole shifts or removal are required, this design eliminates the necessity of disconnecting or reconnecting services under most conceivable condition of pole handling including replacement.



TWO-WAY connection assembly split service to clear the guy on T-tap pole. Prefabricated insulation eliminates taping



FOUR SERVICE attachments can be made to one connection assembly. Connector and cable neutral supply service support

Acceptable Costs . . . Cost comparisons based upon actual field installations indicate that the aerial cable system can be installed on a competitive basis.

Pole Space Saving . . . Actual space occupancy on the pole is 1¾ in. for either a three or four-wire aerial cable system, as against 24 in. for the three or 32 in. for the four-wire open secondary systems. This should be an especially valuable consideration in joint-use construction with communications companies.

Less Manhours to Build . . . Although the material costs of the aerial cable system are higher, secondary mains and services can be installed in one-third the time required for an open-wire system, because all connectors are installed on the secondary mains at the time of their installation. Service attachments are easily made using only an Allen wrench either at the time the secondary is installed or when the service is connected at a later date without interrupting any other service previously installed. This condition holds true for service removals.

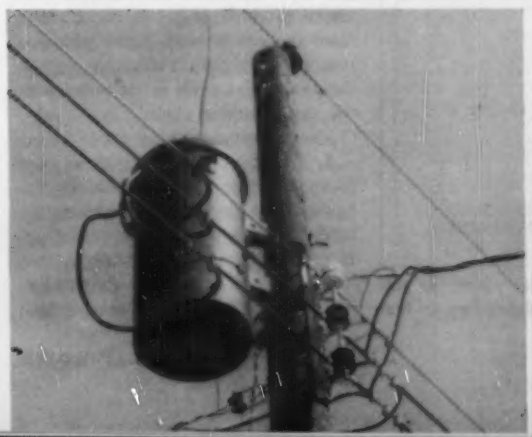
Improved Service Reliability . . . Because of its reduced space requirements and the fact that the aerial cable has fully insulated Neoprene covered conductors, its resistance to tree troubles and other storm damage will improve service reliability.

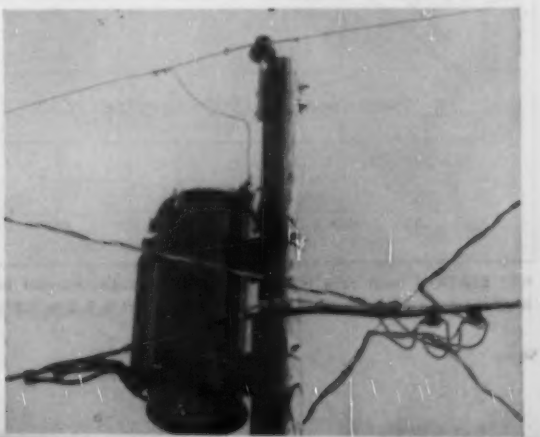
Other Advantages . . . In addition to the above, some intangible improvements are evident although harder to evaluate at this stage of development. Some of these improvements include better appearance of secondary system, less maintenance, and fewer hardware and connector parts to handle.

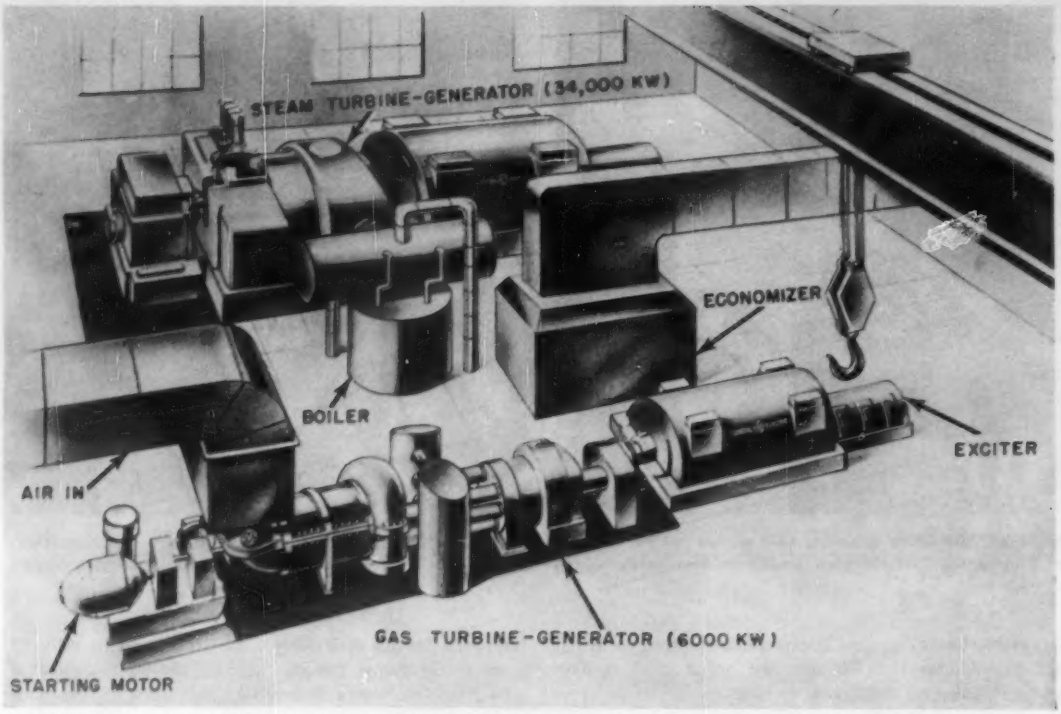
The adaption of this system for four-wire light and power (or multiple street lighting) is entirely feasible and requires only the use of presently available high-strength neutral conductors.

The standard cable size used on this system is based upon a 1/0 all-aluminum phase conductor with a 6/1 ACSR conductor for the supporting neutral conductor. Standard compression type deadends and lines splices can be obtained for use on these conductors.

LESS POLE space is used with aerial cable system. This is valuable consideration in joint-use construction with communication companies. Actual pole space occupancy is 1¾ in. against 24 in. for three conductor open-wire system





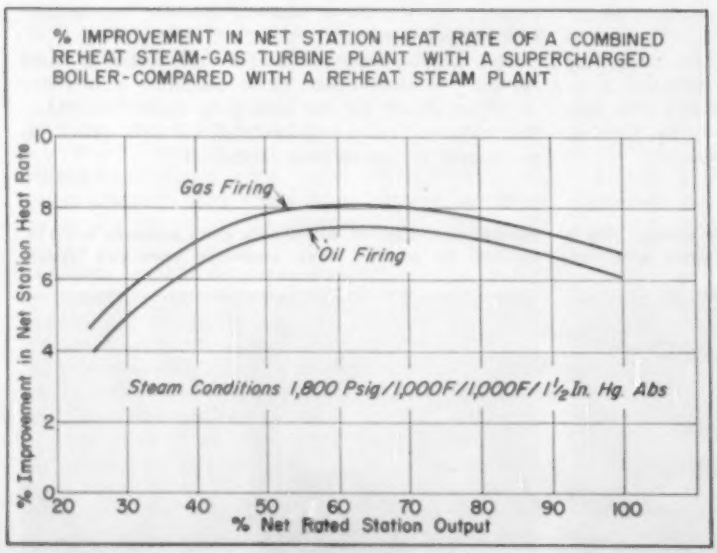


SUPERCHARGING STEAM BOILER WITH GAS TURBINE EXHAUST REDUCES BOILER WEIGHT AND VOLUME AND PLANT SIZE

GENERATION—Design

Is Steam-Gas Cycle the Answer?

Plant efficiency, output upped when gas turbine exhaust supercharges boiler, heats the feedwater, powers heat recovery boiler, or supplies combustion air



NET STATION heat rate is improved in the supercharged boiler plant. At full load increase over the conventional boiler plant is 6.5 to 7.5% depending on fuel

W. B. WILSON, Manager, Power Generation Engineering,

A. A. HAFER, Manager, Product Planning and Marketing Research, Gas Turbine Department, General Electric Co, Schenectady, N. Y.

Compressed air from the main engine compressor, hot exhaust gases, and oxygen retained in the hot exhaust gases, in addition to shaft power, are useful products that can be obtained from the gas turbine. These products result in higher plant efficiencies when the gas turbine cycle is combined with the steam turbine cycle.

Various combinations exist:

1. Gas turbine compressed air used to supercharge a boiler with the exhaust of the gas turbine preheating the feedwater and/or the compressed air. Hot, pressurized gas discharge from the boiler used to drive the gas turbine.

2. Gas turbine exhaust used to heat

the feedwater for steam generator.

3. Gas turbine exhaust used to generate steam in an exhaust heat recovery boiler.

4. Gas turbine exhaust used as highly preheated combustion air.

If the above combinations are effected properly, the efficiency of the combined plant will always be higher than either the steam cycle or the gas cycle alone. When the gas turbine exhaust is used to heat the feedwater, the heater or economizer surface in the normal steam plant is replaced. If an exhaust heat recovery boiler is used, the steam generated can be used for either process purposes or power. Tests indicate a gas turbine, with an exhaust temperature of 840 F, can economically generate steam up to 650 F in an exhaust heat recovery boiler.

The plant efficiencies obtained by using the gas turbine exhaust as preheated combustion air in a steam boiler, or to supercharge the boiler are also attractive because the steam cycle is modified so that work is obtained from the combustion gases without a corresponding increase in the power plant loses. Gas turbine stack losses are also eliminated by combining the two cycles.

Supercharged Boiler . . . Studies indicate that an efficiency ranging from 40 to 45% can be attained with a combined plant using this principle. In addition, this use of the gas turbine has the following benefits:

1. Reduction in boiler weight and volume.

2. Reduction in power plant building volume.

3. Elimination of forced and induced draft fans.

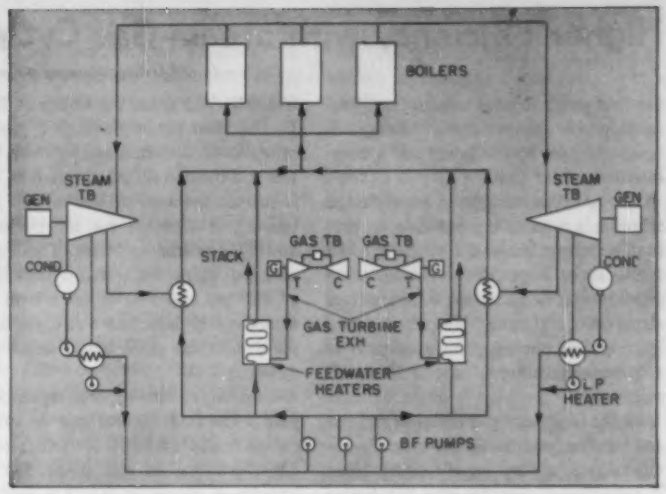
4. Quicker starting of steam boiler.

5. Less field erection labor for combined power plant.

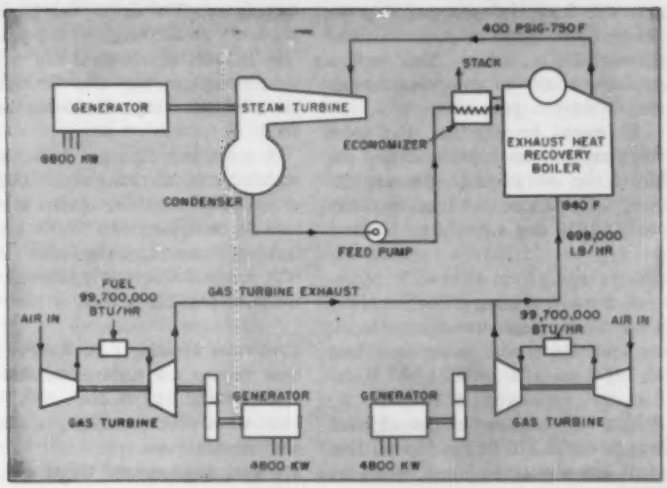
This combination of the gas turbine cycle and the steam turbine cycle compares favorably in efficiency with the supercritical pressure plant. In general, the power output from the gas turbine will represent 10 to 20% of the plant rating.

The cycle is especially interesting because the gas turbine can be superimposed on any steam plant and improve the efficiency by about 5%. Significance of this cycle cannot be overlooked as this is the same gain obtained by using reheat.

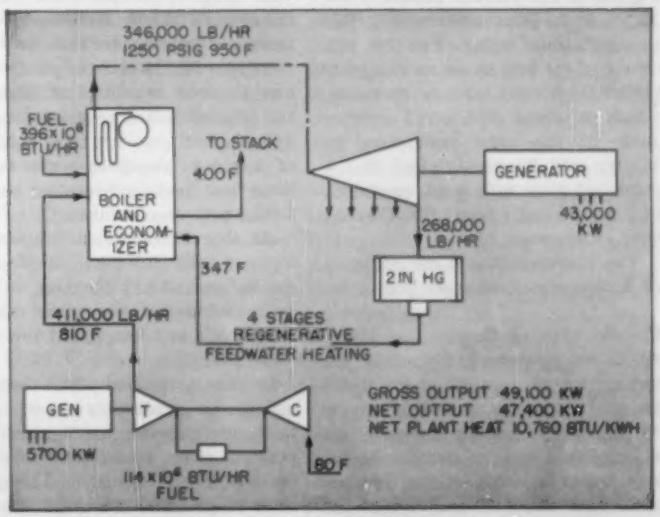
Heat from the gas turbine exhaust can be recovered by partially heating



Gas turbine exhaust used for feedwater heating



Gas turbine exhaust used in heat recovery boiler



Gas turbine supplying all combustion air for boiler

Higher Efficiency with Steam-Gas Cycle

(Continued from previous page)

the feedwater for the steam plant, preheating the compressor discharge air before it goes to the boiler, or a combination of the two.

Use of a gas turbine to supercharge a boiler is a relatively old idea, having first occurred about 25 years ago. In 1934, three large Velox boilers were placed in service in Europe. Since then more than 100 such boilers have gone into service abroad. These operate at a furnace pressure of about 30 to 50 psi.

In the supercharged boiler plant, the gas turbine combustion system is removed, and air leaving the compressor is introduced directly into the boiler where all plant fuel is burned. Hot pressurized gas is discharged from the boiler (after generating steam) and drives the gas turbine. This turbine provides power to compress the air and to drive a generator.

As would be expected, the more complex the gas turbine cycle, the higher the overall plant thermal efficiency. Rohsenow and Bradley indicated in 1950 that a combined plant of this type would have a thermal efficiency ranging from 40 to 45%. Moreover, a study of a supercharged boiler plant having regeneration, intercooling, and reheat, with steam conditions of 1,665 psi and 1,000/1,000 F, by Roe and Cummings (EW Nov 20, 1950 p 111) indicated an overall plant heat rate of 8,420 Btu per kwhr. This plant has a net combined output of 50,000 kw with the gas turbine supplying 10,000 kw. Thermal efficiency was 40.5% at the generator terminals. This is significantly higher than the efficiency of the best steam turbine plant (150,000-kw size) now in operation, which is about 38%. Still another study of this same type plant by Martyn and Baron indicated that a combined plant with steam conditions of 2,000 psi and 1,050/1,000 F would have an efficiency of 41.6%.

This is comparable to the efficiency of a supercritical pressure plant.

Provide 15% of Output . . . For a 40,000-kw supercharged plant the gas turbine would provide about 6,000 kw, or 15% of the total plant output. All of the compressor discharge air is introduced into the steam boiler as combustion air. The boiler furnace operates at about 87 psia. Either gas or oil fuel is burned in the boiler. Gas is discharged from the boiler at 1,450 F, and then passes through a gas turbine. As the exhaust temperature from the turbine is still at about 840 F, it is further lowered to 300 to 400 F by passing it through an air preheater and economizer in series. This supercharged plant with steam conditions of 850 psi and 900 F has a heat rate of about 8% less than a straight steam plant with the same initial steam conditions.

Two larger size supercharged boiler plants burning natural gas or specification residual fuel oil are under active consideration. In one plant, the gas turbine is rated 15,000 kw and the steam turbine 100,000 kw. The gas turbine supplies air to the boiler at about 75 psia. Energy in the gas turbine exhaust is recovered not only in an economizer, but also through an air preheater and a feedwater heater stage.

A large supercharged boiler plant with a combined rating of 230,000 kw also shows attractive gains in heat rate. In this plant, two 15,000-kw gas turbines supercharge the boiler. Work is in progress which, it is believed, will result in coal being used as fuel.

Feedwater Heating . . . Recovery of heat in the gas turbine exhaust for feedwater heating is one of the simplest ways of combining gas turbine and steam cycles, particularly when it is desired to expand steam plant.

When many of today's older plants were built, it was not economical to install more than the bare minimum of feedwater heating because low fuel costs prevailed. But these plants must now improve overall plant efficiency and increase plant generating capacity when fuel costs are high. Addition of a gas turbine-generator with exhaust heat used for feedwater heating fulfills both requirements.

As the rated exhaust temperature for a typical 5,000-kw simple-cycle gas turbine is 840 F, there is flexibility as to just where the exhaust energy can best be utilized for feedwater heating.

In one installation where two gas turbines are installed for power generation and feedwater heating, the temperature of the feedwater is raised as much as 275 F. Actual feed temperatures range from 150 to 200 F with feedwater discharge temperatures ranging from 280 to 425 F. Heat recovered in the feedwater is about 40 million Btu per hr from each unit. This is overall gas turbine plant efficiency higher than 60% when the plant is credited with the heat added to the feedwater.

What Size Heater? . . . Economics, based on fuel costs and other factors, are the most important consideration in selecting the required amount of heat transfer surface. Studies indicate that exit stack gas temperature can approach entering feedwater temperature within 100 F, or less. Maintenance problems must also be considered in arriving at minimum feedwater or stack temperatures. Corrosion problems usually do not occur when metal temperatures are kept above the dew point of stack gases.

Exhaust duct sizes and area of heat exchanger gas passages are selected by evaluating the decrease in turbine output resulting from increased exhaust pressure. For instance, the output of a particular 5,000-kw unit is reduced about 100 kw when exhaust pressure is increased by 4 in. of water. Total pressure drop through ducting and feedwater heater will range from 3 to 10 in. of water.

Heat Recovery Boilers . . . This means of combining the steam and gas cycle is useful where process steam is desired in addition to electric power. Overall thermal efficiency of the gas turbine portion of plants using exhaust heat recovery boilers can be as high as 60 to 70% when credited with heat added to the steam.

Because of the highly efficient combustion of fuel in the gas turbine and the relatively low temperature (840 F) of the gas to the exhaust boiler, maintenance of boiler equipment should be extremely low. Exhaust heat boilers can supply steam at pressures of 400 psig or more and at temperatures of 650 F or more. The exhaust heat recovery boiler may be the only source of steam, or it may supplement other sources. As with feedwater heaters, the actual surface that can be economically justified depends on fuel costs and other considerations.

Where the gas turbine is combined with non-condensing or automatic-extraction steam turbine power plants supplying both steam and electric

power, the ratio of power generation with the gas turbine and the steam turbine depends on pressure and flow of the steam required for process. For plants utilizing straight condensing steam turbines, the gas turbine supplies about 60% of the total kw generation and steam to drive the steam turbine for generation of the additional kw.

Supplementary Firing . . . Flexibility of operation can be greatly increased by firing the exhaust heat boiler with supplementary fuel. Because the gas turbine exhaust is rich in oxygen, about 17% compared to 21% for free air, the exhaust from a 5,000-kw gas turbine can supply sufficient oxygen for burning fuel required by a boiler rated 250,000 to 300,000 lbs per hr. Supplementary firing also permits selection of boiler pressures and temperatures higher than practicable with exhaust heat recovery boilers supplied with 840 F exhaust gas only.

In this combination, forced and induced draft fans are not required, oxygen for combustion of supplementary fuel being supplied in the gas turbine exhaust. Output of a simple exhaust heat boiler can be doubled or tripled by supplementary fuel firing at an increase in boiler cost of 30 to 40%.

In combined steam gas turbine power plants generating electric power only, the increased steam from the supplementary fuel fired exhaust heat boilers means higher kw output from the steam turbine portion of the plant. In combined plants supplying steam and electric power, the more prevalent arrangement in industrial plants, supplementary firing can supply the plants' variable demand for process steam extracted or exhausted from the steam turbine.

Combustion Air . . . The following benefits are obtained when the gas turbine is used to provide combustion air for a steam plant:

1. Much of the energy in the gas exhaust is recovered in the steam boiler, thereby decreasing the quantity of fuel burned.
2. Capacity of the steam power plant can be increased when the boiler is the limiting factor.
3. Improvement in plant heat rate.

In using gas turbine exhaust as preheated combustion air, the gas turbine may be sized to provide either the full combustion air requirements, or only a part with the balance supplied by conventional forced-draft fans. When the gas turbine supplies the full combustion air requirements, it drives a generator in parallel with the main steam turbine generator. As an example, a 6,000-kw turbine (operating at 5,700 kw with 10 in. of water back pressure) provides all combustion air required by a boiler supplying 1,250 psig, 950 F steam for a 44,000-kw condensing steam turbine. This gas-fired plant would have a net plant heat rate of 10,760 Btu per kwhr, an improvement of 7.5% over a typical steam plant operating at the same steam conditions. Based on 70% plant factor, 15% gross fixed charges and 25¢ per million Btu for fuel, the improvement in lower heat rate of this combined cycle is worth $420,000.

Boiler Feed Pump Drive . . . If the gas turbine exhaust provides only part of the combustion air, the gas turbine may be used to drive a boiler feed pump. The variable-speed, simple-cycle gas turbine is well suited for this service, especially for high pressure units. Optimum speeds of the gas turbine and large centrifugal boiler feed pumps coincide closely. Gas turbines in the 3,000 to 7,000-hp range normally operate at speeds between 5,000 and 7,000 rpm while those in the 2,000 to 3,000-hp range are designed for speeds up to about 9,000 rpm.

Studies show that the overall net station heat rate of an 1,800 psig, 150,000-kw turbine generating plant is improved 1.25% when a gas turbine is used for boiler feed pump drive. Net station kw output is increased by the amount of the boiler feed pump power, about 2%. In large, supercritical pressure plants, additional capacity alone may justify the cost of the gas turbine drive for the boiler feed pump, leaving the improved heat rate as a net gain.

A gas turbine driving a house generator can be used for supplying part of the boiler combustion air of a combined steam-gas turbine plant. Addition of a 5,000-kw gas turbine driving a house generator and exhausting highly preheated combustion air to the boiler of a 150,000-kw, 1,800 psig, 1,000/1,000 F steam turbine plant improves the net plant heat rate about 1.6%. The gas turbine also provides the station with an independent, self-contained, quick-starting prime mover.

Combination Flow Gas Turbine . . . Significant heat rate gains can be obtained with a combined flow-gas turbine where high pressure (200 psig or above) natural gas is the fuel. In this combination the gas turbine exhaust is used as combustion air for the steam boiler. Natural gas fuel for the main steam plant is passed through a preheater heated by either the boiler uptake gases or the gas turbine exhaust. The fuel is then passed through a flow turbine which discharges at about 20 psig to the boiler fuel supply system. Gas turbine fuel is extracted from the flow turbine at a pressure of 150 psig. Exhaust of the gas turbine is then used as highly preheated combustion air for the steam plant boiler. Total generator output of the gas turbine and flow turbine connected in tandem is about 10,000 kw, of which 5,700 kw is provided by the gas turbine. Combining a flow-gas turbine of this size with a 170,000-kw steam plant results in provision of about 20% of the boiler combustion air requirements, 5.9% increase in plant capacity, and about 2.7% reduction in overall station heat rate. Exact magnitude of advantages depend upon the initial gas pressure. But the reduction in heat rate is about half the gain afforded by reheat.

Use in Older Plants . . . Gas turbines will be used in a number of different types of combined steam-gas turbines plants. In older medium-size steam plants (20,000 to 100,000 kw), simple-cycle gas turbines exhaust will either heat feedwater, or be used as highly preheated combustion air for the boiler. Selection of method is governed by the station conditions. If boiler capacity is a limiting factor, the exhaust will be utilized for feedwater heating; if steam turbine capacity is limiting, the gas turbine exhaust will be used as combustion air for the fuel-fired boilers.

Gas turbines will be used to drive boiler feed pumps or generators in large central stations (150,000 kw or larger), with the exhaust either heating feedwater or being used as combustion air in the boilers. In gas-burning steam plants, the flow-gas turbine combination is attractive with the exhaust also used as boiler combustion air. For new medium-size steam plants, the gas turbine will provide all of the boiler combustion air or supercharge the boiler. In the larger new steam plants, the gas turbine will play an important future role in the supercharged boiler plant.

EHV Cables Seen as Rising Need

L. I. KOMIVES, Chairman, Task Group, Cable Engineering Section, Association of Edison Illuminating Companies, and Underground Engineer, Detroit Edison Co, Detroit, Mich.

High-voltage and extra-high-voltage (EHV) cables will be needed increasingly by the electric utilities of the United States and Canada in the next 20 years, a task group of the Association of Edison Illuminating Companies' Cable Engineering Section recently reported.

The task group, together with invited manufacturers' representatives, conducted a study to determine the extent of this need as a basis for organizing a research project to develop the cables required. The cost of such research will be greater than any one or even a few companies would want to undertake.

System planning engineers are becoming more interested in higher-voltage transmission as they encounter mounting difficulties in obtaining plant sites close to load centers and rights-of-way for overhead lines in built-up areas. Approximately twice as wide a right-of-way is needed for four 220-kv lines transmitting the same power as one 380-kv line. This situation has turned American engineers' attention to European developments in EHV transmission over some years.

Survey Shows Need . . . The task group sent questionnaires to 131 utilities in the U.S. and Canada and received 110 replies. These replies indicate that two utilities have 287 and 330-kv lines, respectively, and that 22 are considering increases in transmission voltages above 230 kv. Five companies are considering going to 330-kv or higher, and eight to a range between 230 and 400 kv. Fifteen of the 19 considering a move to 230 kv, have definitely decided in its favor.

The survey also showed that 18 companies are using or considering voltages above 230 kv, of whom four will use cable. Of the 20 utilities considering voltages at or near 230 kv, four will use cable. From the survey it appears that the utility industry will need underground cables rated at 230 kv and above within the next 15 years. Reports since the survey was completed indicate that more companies are actively considering higher transmission voltages than are reported in the survey, the results of which are summarized in Tables I and II.

Field tests like those being conducted on 225-kv cables in France and on 275-kv cables in Great Britain will be necessary to assure that cables developed here will be suitable to American load conditions. Such a program will take at least six and may take ten years.

Initial Steps Taken . . . The task group has held discussions with cable and accessory manufacturers who expressed a willingness to begin preliminary research leading to the development of cables in the 300-400-kv range, provided utilities as cable users will share the appreciable expense. These manufacturers said that they expect to submit cable samples for field tests in that range in four years.

Prerequisite to field tests, the cables developed must be proved in the manufacturers' own laboratories and must show promise warranting the expense of field tests. In view of the benefits to themselves, the manufacturers have indicated that they will cooperate with talent, facilities, and funds.

Research Will Be Costly . . . Field tests alone will need an appropriation of about $500,000. This amount would be spent in the three or four years starting in 1958 or 1959, whenever manufacturers can provide test samples. Table III breaks down the estimated cost of the field testing program.

Cables in the 100-150-kv range present no technical hurdles, and low-pressure, oil-filled cables in the 220-230-kv range have proved themselves in European service. But the 275-300-kv range approaches the critical voltage limits for present installations because of dielectric losses. In this range tests are in progress, and one line in service.

The 400-kv cable used in Sweden was made by Swedish and French manufacturers. Without further testing, it could be recommended for installation in this country for short station entrance cables in well ventilated areaways or tunnels. Indications are, however, that long cable lines at voltages above 300 kv will not be needed here for ten years. As development work will take that time, it should begin without delay.

European Experience a Guide . . . The extensive use of water power in several European countries and the transmission of large blocks of power over distances considerably longer than those thus far encountered here have necessitated the earlier development of EHV transmission abroad. Soon after EHV overhead lines were put in service it became evident that transmission by underground cable, serving as short station ends or as longer system ties, would sometimes result in simpler and more economical transmission design. This experience offers a criterion for the development of cables for service in this voltage range.

Europeans have had experience in several voltage ranges, such as:

1. In the 380-425-kv range. A short length (four cables, each 100 meters long) of high-pressure, oil-filled cable has been in service in northern Sweden for almost three years at 400 kv. This cable is rated at 400 Mva, 600 amp and has carried 70% of its rating quite regularly. It is in an ideal location with respect to ambient temperatures and heat dissipation.

Three recent Swedish installations are similar to the earlier one, except that the cables are expected to carry 1,200 amp continuously at 425 kv, equivalent of more than 800 Mva, under controlled ambient temperature of 25C maximum. A 380-kv, high-pressure, oil-filled cable is under test at the Fontenay laboratories of Electricite de France. The cable is being tested in the open, not buried in the ground. A 225-kv, buried, pipe-type compression cable has been under 380-kv test for over a year at a manufacturing plant in France. At 380 kv, it is rated at about 400 Mva.

2. In the 275-300-kv range. Canadian and British manufacturers have built and installed low-pressure, oil-filled cables 1,500 ft long for 300 kv service in northwestern Canada. Three British manufacturers have submitted sample lengths to be tested at Staythorpe, Midlands, by connecting them in series with one phase of an existing

by Utilities

275-kv overhead line. Three such samples—one low-pressure, oil-filled; one self-contained, impregnated pressure; and, one self-contained compression—have been under test since March 1954. While comparatively light loads have been carried thus far, loads resulting in 80C copper temperature are expected soon. Surges have been recorded with no apparent harmful effects.

3. In the 220-230-kv range. Many installations in this range are in service in European countries, all low-pressure, oil-filled type cables. Best known of these is the 5-mile Paris line which, serving as a system tie, has been in use since late 1935 and has a very good service record. Although this cable type has been accepted generally in Europe, comprehensive, long-time tests are being made by Electricite de France on six other types of 225-kv cables to reduce costs of such installations. Several are pipe type, and some self-contained, high-pressure type.

4. In the 100-150-kv range. The highest voltage cables in service in the United States are in this range. There are in service approximately 250 miles of high-pressure, pipe-type cables and almost as much low-pressure, oil-filled, self-contained cables. Experience indicates that the performance of all is satisfactory, so that selection of type can be made on the basis of lowest cost of installation.

Table III—Estimated cost of field testing program

A.	Layout and installation of cable as shown in Fig 1 $160,000 of this amount is for terminals and instruments recoverable through salvage. Cable furnished by manufacturer.	$308,800
B.	Current loading equipment, large percentage salvageable.	$41,000
C.	Transmission, large percentage salvageable.	$18,500
D.	Manpower—15,000 hr	$75,000
	Total (Up to $225,000 salvageable)	$443,300

Table I—Companies now having or intending to raise transmission voltage over 230 kv

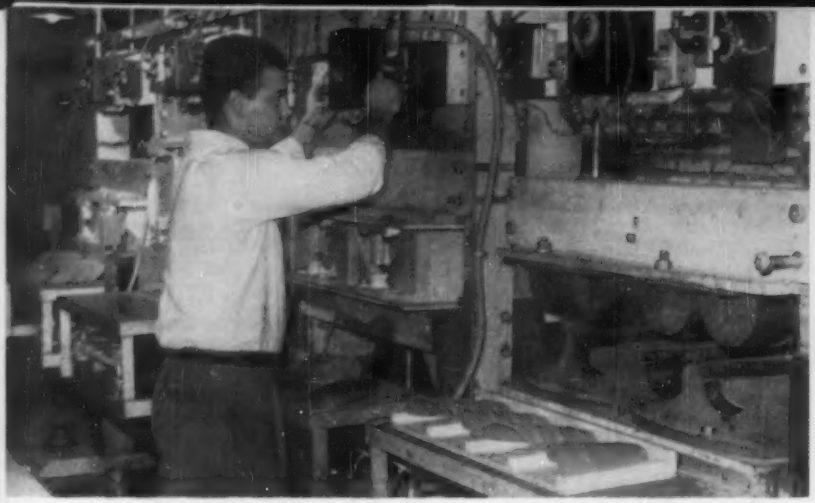
No.	Present Max. Transmission Volts 100–138	139–169	170–230	Will Raise	To What?	Will Use Cable
1	(c)	x		Yes	?	Poss.
2		x		Yes	?	No
5			x	Yes	345	Yes
15			x	Yes	330	No
21	(c)		x	Yes	330	Yes
40		x		?	?	No
45		x		Yes	?	No
52	x			Yes	230 or 330	No
54		x		Yes	?	No
68	x			Yes	230 or 330	No
70			x	?	?	No
72	x			Yes	230, 300 or 345	No
76	x			Yes	230 or 330	Yes
77			x	?	?	Poss.
79	(c)		x	?	?	Yes
82	(c)		x	Yes	300	No
93		x		Yes	360	No
98			x	Yes	287 or 345	No
101			x	?	?	No
103	x			Yes	230 or 330	No
105	x(c)			?	230 or 287	No
108	(c)		287	No	...	No
109			330	No	...	Poss.
110	x(c)			Yes	330 or 400	Yes

(c)—Have cable now in this voltage range.

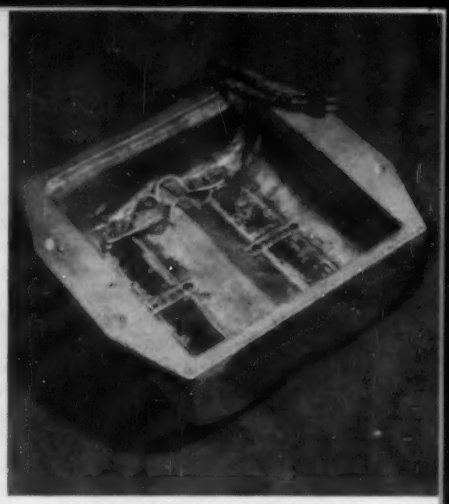
Table II—Companies now having or intending to have transmission voltage of 230 kv

No.	Present Max. Transmission Volts 100–138	139–169	170–230	Will Raise	To What?	Will Use Cable
4	x(c)			Yes	230	No
7	x			Yes	230	No
8	x			Yes	230	No
11			x	.....	...	No
25	x(c)			?	230	Poss.
26			x	.....	...	Yes (110 kv)
27			x	.....	...	No
30	x(c)			Yes	230	Poss.
33			x	.....	...	Yes
34		x		Yes	230	No
35			x	.....	...	No
41	x			Yes	230	Poss.
46	x			Yes	230	Poss.
50			x	.....	...	Poss.
51	x			?	230	Poss. (115 kv)
53	x			Yes	230	Yes
55	x			?	230	No
56			x	.....	...	Poss.
57	x			Yes	230	No
60	x			Yes	230	Yes
62	(c)		x	.....	...	No
67	(c)		x	.....	...	Yes
69			x	.....	...	No
71			x	.....	...	Yes (138 kv)
74			x	.....	...	Yes (138 kv)
80	x			Yes	230	No
81	x			Yes	230	No
83	x			Yes	230	No
85			x	.....	...	No
87	x			?	169 or 230	No
89			x	.....	...	No
91	x			Yes	169 or 230	No
92	x			Yes	230	No
99			x	.....	...	No

(c)—Have cable now in this voltage range.



SHIN GUARDS and shoulder pads for football players are molded of fiber board at Rawlings Mfg Co. This press has eight 500-w strip heaters in which . . .



. . . ALUMINUM MOLDS are kept at 325F by heaters fastened into grooves

INDUSTRIAL—Operation

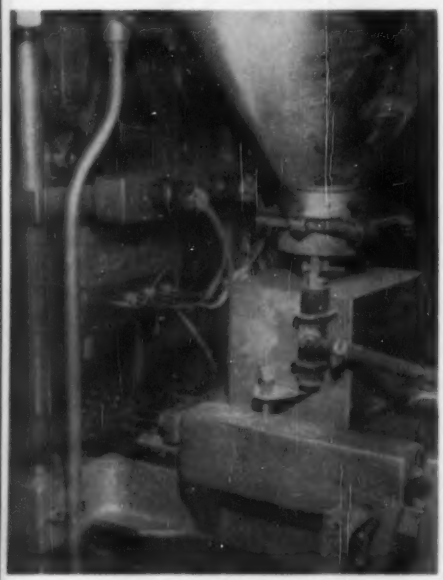
Controlled Heat Improves Output

Economy is key to industrial application of electric heat. Immersion, induction, dielectric, infrared heaters have their places in modern production

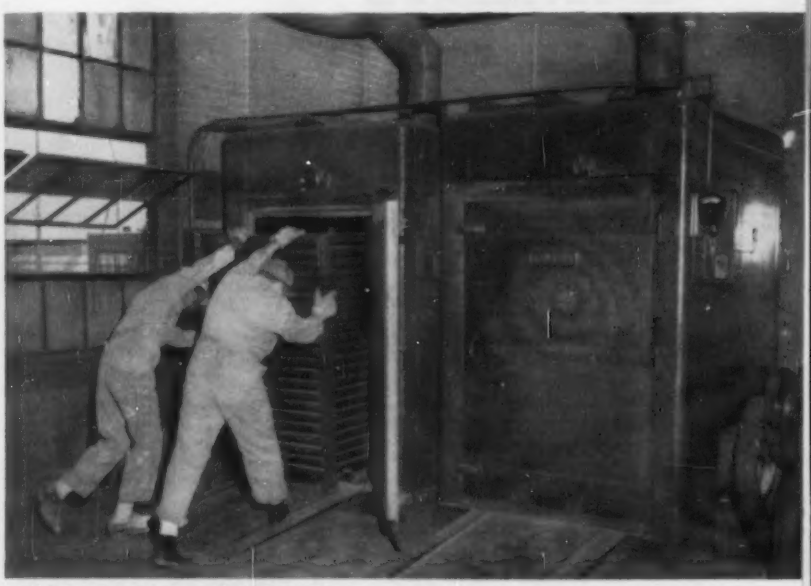
H. W. McLARNEY, Union Electric Co of Missouri, St. Louis.

Union Electric Co of Missouri has adapted General Electric's National Industrial Productivity Forum to its own territory and put it on district-by-district before the managements of small plants. Types of electrical applications in industry that have been covered include electric heating, lighting, and mechanization and automatic operation. In the field of electric heating the story told these management groups can be summed up in one word: "Economy."

- Economy obtained through the ability to control temperatures and quantities of heat accurately.
- Economy resulting from the manufacture of more



PLASTIC is molded in this press. Cartridge heaters in both dies draw 4 kw



ANIMAL MEDICINES are dehydrated in these twin-20-kw ovens. Water serves as a mixer for ingredients but must be removed before packaging of product

uniform, better quality products with fewer rejects.

• Economy brought about by improved working conditions and better efficiency of employees in the plant.

Today electric heat plays a major role in modern industrial production. A complete line of small heating units, melting pots, ovens, furnaces and other equipment are available for a variety of industrial applications. This equipment ranges in size from a 50-w cartridge heater, used to mold plastic tips on shoe laces, up to a giant arc melting furnace, 30,000 kw in capacity, which melts steel at the rate of 50 tons an hr.

Factors To Consider . . . Some important factors to consider when selecting industrial heating equipment are:

1. Operating Cost. The cost of process heat in a manufacturing operation is usually a small part of the total cost of the finished product—it averages less than 1%.

2. Subsequent Operations. Properly applied heat can eliminate or minimize the cost of subsequent operations such as cleaning, machining, straightening or grinding.

3. Transportation of Parts. Electric heating equipment can usually be placed directly in the production line, whereas fuel-fired equipment may have to be placed in another location for reasons of safety or lack of space.

4. Labor and Supervision. With modern electric and electronic control equipment, labor and supervision costs are considerably reduced.

5. Maintenance. Maintenance of electrically heated equipment is low, resulting in fewer shutdowns.

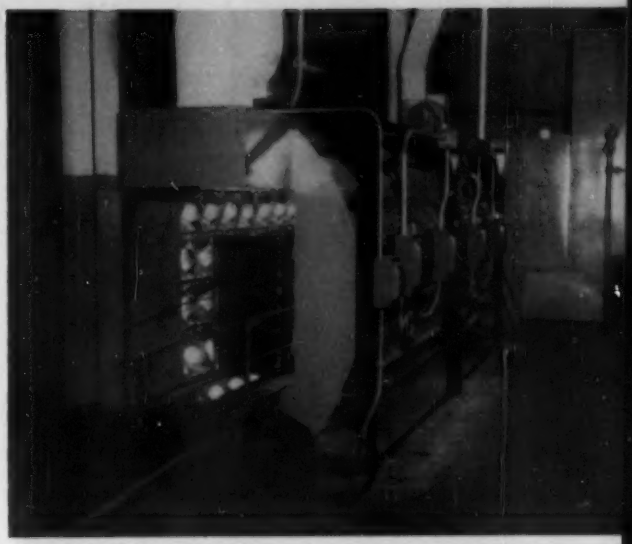
6. Working Conditions. Improved working conditions is definitely one of the principal advantages of electric heat, but its importance is not always fully appreciated. Employee comfort is desirable both from the standpoint of human relations and profitable operation.

Small Electric Heating Units . . . Small units commonly known as metal sheath heaters perform five basic heating functions. They heat liquids, surfaces, process air, pipe lines, and they melt soft metals. The heating of liquids such as water, oil, plating solutions, and chemicals is one of the most common and efficient applications of electric heat.

This means the unit usually can be immersed directly in the liquid. This means practically 100% efficiency, as heat is transferred directly from the heater to liquid.

Less Labor, More Production . . . Time and money were saved when two 2,000-w immersion heaters were harnessed to a large hydraulically operated metal brake used to bend heavy gauge steel sheets in Nooter Corp's plant, St. Louis. Installed in the reservoir tank of hydraulic oil, the thermostatically controlled heaters hold the fluid at 70F in cold weather. Formerly two men had to report to work from 30 to 60 min early to get the brake in working condition before the factory force arrived. Operation cost of the heaters is about 5c an hr. Total investment: Less than $100.

Copper Plating . . . Immersion heaters were put in a copper plating tank at Jasper-Blackburn Corp to preheat a bath for the day's operation. During plating, usually enough heat is generated in the bath to maintain the desired temperature. Over night and over week ends it was necessary to maintain steam pressure in the boiler to hold the tanks at temperature. Eight 5-kw heaters were specified and installed. A special rack and air hoist lowers heaters into the bath and raises them out of the way when the tank is in use. This scheme is convenient and fool-proof, and has eliminated the labor and expense of firing the steam boiler at night and over the weekends.

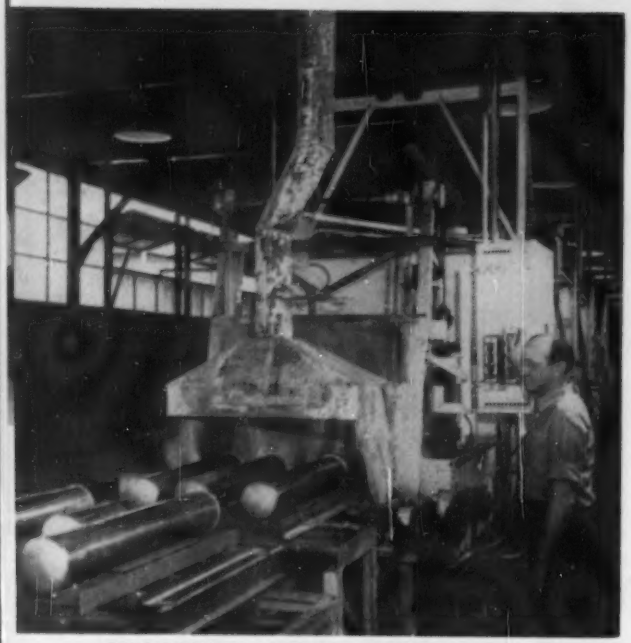


INFRARED OVEN bakes finish on 30- and 55-gal drums in 7 min for oil and anti-freeze distributor. Output: 60 an hr

DIELECTRIC HEATING UNIT of 48 kva capacity bakes cores in 15 min for foundry. Fuel-fired oven required 5 to 6 hr

Aluminum Anodizing . . . A continuous aluminum-anodizing process in the plant of Monarch Metal Weather Strip Corp employs a series of tanks (containing cleaning and rinsing solutions) which precede the anodizing chamber. The first tank holds a caustic cleaner kept at practically its boiling point.

Two 15-kw immersion heaters are installed in this caustic solution tank. This is rough service for heating



CONVEYORIZED BRAZING in a 320-kw furnace boasts a high output for small parts. Special atmosphere thwarts rust

ELECTRIC ARC FURNACE melts 3 tons of steel an hr. Top of this 1,800-kw unit swings off to make recharging easier

Here's How Some

units. Although the heater fins become nearly covered with sediment, the heater still maintains its efficiency. This is because the sludge becomes radiant too.

Surface Heating . . . Tubular heaters are so versatile that they can be used for almost any kind of surface heating application. But strip heaters with broad flat surfaces are specifically designed for direct clamping. Another type designed to warm surfaces is the small cartridge heater. It is inserted into drilled holes. The cartridge unit is particularly well suited for tight quarters where so-called "spots" of heat are required.

Strip Heaters . . . In the Rawlings Manufacturing Co plant, strip heaters are used for molding fiber board for football players' shin guards and shoulder pads. The press is equipped with eight 500-w strip heaters which are thermostatically controlled to about 325F. They are clamped and cemented into grooves in the aluminum molds. The cost of this "electrified" press amounts to about 7c an hr.

Cartridge Heaters . . . In Cinch Manufacturing Corp's plant, cartridge heaters are used on a compression molding machine for plastics. The heaters are slipped into holes drilled in the upper and lower dies. This press is fully automatic. Plastic material feeds from a bin, and the heated dies close and open automatically. The finished product is ejected by a stream of compressed air.

This is an operation where it was practical to replace manhours with kilowatthours. The cost advantage lies with automatic operation. In this case, the hourly operating cost of the press, using 4 kwhr per hr, amounts to about 7c, whereas the average wage rate for a press operator is about $1.35 or more an hr.

Heating Air . . . Baking, curing, drying, ripening, warming, preventing condensation, or controlling humidity—these are the processes where electric heat performs outstandingly.

Two 20-kw ovens, in the Ralston Purina Co's plant, dehydrate an animal medicine compound. Water serves as a mixing medium for the ingredients but must be removed before the medicine is packaged. This drying process requires 2½ hr at 250F, with forced-air circulation in the ovens.

Pipelines . . . Transmission of various liquids through pipelines has posed the problem of how to keep viscous liquids free-flowing during the manufacturing process. Tubular heaters provide an easily applied, inexpensive answer to this problem. They simply wrap around or clamp to the pipelines.

For example, asphalt mixing and storage plants are large users of tubular heaters. The heaters are installed along pipelines from the railroad car to the storage tanks. The storage tanks, valves, and pumps are all heated with immersion or tubular units. Heaters are clamped to the pipelines, covered with sheet metal, insulated with asbestos, and weather-proofed with a water-repellent paint. Consequently, liquid asphalt is delivered to the trucks, without stoppage, in an easily workable condition.

Companies Are Using Electric Heat Effectively

Space Heating . . . An ideal way to provide heat in a watchman's office, crane cab, or an office or stock room in an isolated spot is to do it electrically. In many cases it would be difficult and expensive to run steam or gas lines to these locations, whereas an electric circuit is usually available or can be brought in at a reasonable cost.

The watchman's office at Lever Bros' plant is situated about 150 ft from the main plant. The building is about 10 x 18 ft and is heated adequately by four 4,500-w convection-type heaters.

Infrared . . . Infrared or radiant heating is fairly new. It was first used by Ford Motor Co in 1939, and gained wide acceptance during the war because of its adaptability to continuous-processes.

At Dazey Corp, an infrared oven bakes an enamel finish on small kitchen appliances—such as can openers, juicers, and mixers. This concern formerly used a batch-type fuel-fired oven that required a considerable amount of labor. It had to be manually loaded, operated, and unloaded. But a conveyor and a 68-kw infrared oven have reduced both baking time and labor. The materials-handling reduction saves both time and money. The infrared oven also delivers a product with a more uniform, higher quality finish at a reasonable cost. In this case the operating cost for the oven is about $1 an hr.

In the plant of J. D. Streett & Co, Inc, an oil and anti-freeze distributor, an infrared oven is used in reconditioning 30 and 55-gal steel drums. In the spray booth, when the operator presses a button, the turntable automatically turns the drum so that he can spray completely around it without turning it by hand. The drums then move into the oven, where the finish is baked dry in 7 min. The oven occupies about 40 ft of floor space and turns out 60 drums an hr. The operating cost is about 70c an hr, or about 1c per drum.

Induction Heating . . . Induction heating also gained acceptance rapidly during the war, especially in metal processing operations where either the depth or area of the heated zone must be carefully controlled. The time required with induction heating is only a fraction of the time required with any other method, and induction heating consistently turns out products of a uniform and high quality.

Axelson Manufacturing Co makes oil well equipment. The surface of steel couplings, one of its products must be abrasion-resistant and stand up even under blows, while the centers remain soft and ductile to absorb shocks.

A 25-kw induction heating unit turns out 200 couplings an hr, all uniform. The unit is equipped with a fixture arranged for loading at the top. The pieces pass through the induction coil where the surface is heated to 1,500F in 15 sec. They are then quenched with a water spray and discharged at the bottom.

The induction furnace has a much longer pot life, requires less maintenance, and improves the casting quality because the alloys mix better under accurate temperature control. A number of 60-cycle induction melting installations dot St. Louis. Those at Emerson Electric Co and Wagner Electric Co melt aluminum to be cast as rotors for small electric motors. Carter Carburetor Corp uses induction furnaces to melt aluminum for die-casting carburetor and fuel pump parts.

Dielectric Heating . . . Another fairly recent development is dielectric heating which relies upon frequencies in the 10 to 30-Mc range for heating non-conducting materials such as wood, paper, textiles, rubber and plastics.

Dielectric heat can be used also to bake sand cores in a foundry. A special synthetic-type binder is used in the cores, and the 48-kva unit bakes them in about 15 min. Baking time in a fuel-fired oven requires 5 to 6 hr, and even longer for larger cores.

Heat Treating . . . Almost every metal-working plant of any size can justify the installation of some type of heat-treating furnace. The standard box-type furnace is frequently used for heat treating tools, dies, and miscellaneous small parts.

Two 30-kw box-type furnaces in the plant of Nordberg Manufacturing Co are employed in heat treating diesel engine wrist pins and other diesel engine parts. In this kind of installation, a protective atmosphere often prevents oxidation during the heat treating operation. Often the pieces treated are expensive and furnaces which offer the best possible conditions for temperature control, uniform heating, and minimum oxidation generally prove to be the most economical.

Brazing . . . Quantity production jobs often call for conveyorized heating operation to which the electric furnace is particularly adaptable. It can usually be installed directly in the production line. A 320-kw conveyorized brazing furnace is used by Hussmann Refrigerator Co, for brazing headers on refrigerating coils, end bells on pressure tanks, and a variety of small brazing jobs. The output of this furnace, on some of the smaller pieces, runs as high as 1,200 units per hr. A protective atmosphere in the furnace prevents oxidation, thereby retaining the brightness of component parts.

Electric furnace brazing exemplifies how electric heat helps simplify product design, reduces manufacturing time, saves material, and lowers overall production costs. Many parts formerly cast, forged, or machined from bar stock have been redesigned and are being made from lower cost stampings, tubing, and screw-machine parts by means of the electric brazing process.

Steel Making . . . Electric heat is assuming an even more important role in the steel-making industry. For years the electric arc melting furnace was thought of primarily as a producer of alloy steel, but since the war its use in the production of carbon steel has grown rapidly. A number of these arc furnaces operate in steel and grey-iron foundries in the St. Louis area.

The St. Louis Steel Casting Co has an 1,800-kw furnace which melts steel at the rate of 3 tons an hr. The entire furnace top swings away to make charging easy. After a heat is finished and poured, the furnace can be recharged and switched on in less than 5 min.

Parameters of EHV Transmission

- Conductor diameter to hold corona and radio influence (RI) within tolerable limits.
- Insulation for the line.
- Load to be entrusted to one circuit.
- Provision for sleet melting
- Economics as compared with lower voltage lines.

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Utilities today are scrutinizing the parameters of extra high voltage for increasing transmission capability, and several have incorporated EHV into their systems. At the higher voltage some factors of transmission system design have greater impact than at conventional voltages, and there are uncertainties associated with any venturing beyond experience with existing lines. Major speculative aspects of EHV transmission today are given above.

Conductor Diameter Guided by Voltage . . . Practical information developed by the American Gas & Electric Co's 500-kv test project indicates that conductor diameter selection should be based on RI at the operating voltage. Following such selection, a preference can be made between solid and expanded ACSR based largely on loss evaluation.

Analytical studies also showed that, for a given RI level, bundling permits smaller total conductor weights than single conductors without too much effect on tower weight, and the bundle conductor has a smaller conductor cost and greater surge impedance loading (SIL).

Radio Influence Has Many Variables . . . Measurements of RI are affected by unpredictable variations, corona loss among them. Selection of a satisfactory conductor is conditioned by a wide range of variables, including geographical ones. For a given conductor and operating voltage, the most critical of these are: Weather, frequency of received signal, distance of receiving antenna from the line, signal voltage on the antenna and signal-to-RI ratio, and type of receivers, whether AM or FM-TV. At tolerable RI levels and broadcast frequencies, RI varies roughly over a 1-to-5 ratio with the weather, although it may greatly exceed this range on occasion. Very roughly, RI is in inverse proportion to frequency, thus:

Frequency	Relative RI
100 kc	1,000
1 mc	100
10 mc	10
100 mc	1

It is significant that RI attributable to conductor corona is usually a potential factor at power-line carrier frequencies around 100 kc and radio broadcast frequencies around 1 mc. RI levels fall off rapidly as distance is increased between the receiving antenna and the transmission line. In round numbers, intensity varies as follows:

Distance from Outside Conductor—Ft	Relative RI
0	100
100	15
200	5

Signal-to-RI Ratio Is Factor . . . As EHV lines ordinarily traverse relatively unpopulated areas, the number of radio receivers subjected to exposure is small. But most receivers have automatic volume controls which increase sensitivity as the received signal fades. At maximum sensitivity they become most susceptible to RI. Accordingly, in any given receiver location, the signal-to-RI ratio is as important, perhaps more so, than the RI level alone.

In unfavorable circumstances, particularly during daytime, the primary reception area may be 20 to 100 miles from an AM broadcast station, depending on the station's power. The signal intensity is low then and may not compete favorably with RI noise in a receiver close to a transmission line. On the other hand, a broadcast station hundreds of miles away may override RI and give satisfactory service to listeners. Sporadic broadcast interference complaints may be expected even at very low values of RI.

Standard AM broadcast is quite susceptible to RI. Its operating principle depends upon amplitude changes, and its frequencies are in a region of significant RI intensity. Short-wave AM is somewhat less susceptible because of its higher frequency. FM broadcast is practically immune because of its principle of operation and its high frequency, and TV is also little affected for the latter reason.

Converting Test Data . . . Notwithstanding these vagaries, a yardstick for converting test data to design data must be used. One suggestion is the RI produced in fair weather conditions at 100 ft horizontal distance from the transmission line at 1 mc, quasi-peak, as measured by a calibrated instrument. Fig 1 is a guide to the design of single-conductor ACSR lines at EHV to secure 15 μv per meter. It also shows curves for single conductors at 50 μv per meter, and for a two-conductor bundle at 15 and 50 μv per meter.

Probably the zone of acceptable RI lies between 15 and 75 μv per meter at 1 mc 100 ft from the line in fair weather, the spread encompassing the many factors to be considered in establishing a working value. This is important, as will be brought out later, because conductor diameter is an important factor in line cost and there is a limit to increasing conductor diameter by "expanding" conductors.

Despite the limited data on bundled conductors in this

country their use seems desirable at voltages over 360 kv when RI must be held to 15 μv per meter. For an RI of 75 μv per meter, operating voltage of a single-conductor line may be raised to about 440 kv.

Corona Loss Is Normally Low . . . In the vicinity of 330 kv line-to-line it is not difficult to obtain an all-weather, annual average loss under 4 kw per mile of 3-phase line. At 300,000-kw circuit loading, the I²R loss runs near to 60 kw per mile of 3-phase line. Varying with the load factor, corona loss may run from ¼ to ⅛ of total line loss and further reduction cannot be justified in dollars and cents. These figures are based on non-heated conductors; heating associated with load current would decrease corona loss.

Peak loss from corona may reach 100 kw per mile of 3-phase line in heavy precipitation. Such a loss, however, would be short in duration and characteristic only of storm centers. Long sections of line would not be exposed to extreme precipitation rates simultaneously.

Insulation Failures Classified . . . All transmission-line flashovers fall in one of the following categories:

1. Over an insulator string from conductor to ground because of normal dynamic voltage and reduction of insulator breakdown strength by contamination of surfaces, usually aggravated by rain or condensation.

2. Over an insulator string or conductor-to-tower clearance as a result of overvoltage from switching operations.

3. Over an insulator string or conductor-to-tower clearance as a result of overvoltage from lightning.

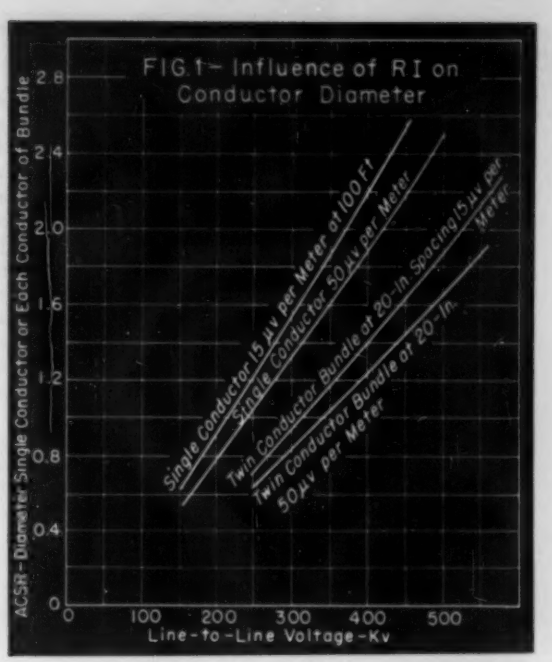
4. Causes essentially mechanical; this type will not be considered.

Flashover of wet clean insulators takes five or more times line-to-ground voltage on all present line construction. But under extreme conditions, insulator-surface contamination, coupled with wetting by rain or fog, can reduce insulation strength to values as low as 15% of the clean wet flashover. In localities of extreme contamination, the remedy for flashover is periodic cleaning rather than more insulators.

Most lines traverse territories where salt, fog, chemical or sooty residues do not cause serious problems. Insulators ultimately acquire a certain amount of dirt which does not cause trouble before rain cleans off part of it to start a fresh cycle of contamination and washing. The degree of contamination to be expected on insulators is difficult to establish from experience, as line flashovers occur from causes difficult to ascertain.

Substations Give Contamination Criterion . . . Performance of substation apparatus bushings may be used as a criterion of line contamination. Such bushings usually are more susceptible to it than line insulators, being normally near smoke-emitting generating stations and/or in industrial centers. Bushings meeting the AIEE standards for voltages up to 115 kv have proved satisfactory in service. Bushings of one voltage class below operation voltage for voltages 115 kv and above have also been satisfactory.

It is assumed that contamination affects bushing flashover to the same degree that it does line suspension insulators and that line insulators with the same 60-cps strength as the bushings would be satisfactory on the line. This may appear to contradict experience, for lines though customarily overinsulated as compared with sub-



stations, experience more flashovers. This argument, however, considers only flashovers caused by dynamic voltage and insulator contamination, not those due to other causes, such as lightning.

As insulator strings are more numerous in service than bushings, line insulation should have a margin over substation bushings to be reasonably immune to contamination flashover. It is proposed that the 60-cps flashover of the line be made 50% higher than the test-withstand voltage of the bushings.

Switching-Surge Flashovers Cut . . . Field investigations indicated some 15 years ago maximum switching-surge voltages 3.5 to 5.0 times line-to-neutral crest, the higher value applying to ungrounded neutral systems. But the transient overvoltage performance of systems has since been improved greatly by faster relaying, faster breaker operation, and improvement of breaker interruptors resulting in fewer restrikes.

Faster relaying and breaker operation reduced overvoltages by lessening arcing time, this change being reflected in a lower flashover probability curve. But probably the greatest improvement has come from reduction of restrikes during the critical time just preceding final arc extinction.

The paucity of more recent tests of system transient overvoltages suggests that switching surges no longer present a serious problem. Spot measurements during field tests on breakers seldom show voltages in excess of twice normal line-to-ground crest. Analog computer studies, exploring numerous combinations, show that corona tends to reduce switching surge magnitudes at higher voltages for typical line designs.

On the basis of available data, it is felt that switching surge magnitudes of three times normal crest at 230 kv and 2.5 times at 440 kv are good engineering compromises. When a straight line connects these points on a graph, it shows that the 50% margin over bushing strength pro-

vided for contamination allows adequate margin for switching surges also.

Lightning Flashovers Predicted . . . "Transmission Line Design and Performance Based on Direct Lightning Strokes," by E. L. Harder and J. M. Clayton, AIEE Transactions, Vol. 68, Part I, 1949, pp 439-49, provides data discussed hereafter. It indicates, for example, that a line having 16 insulators and 20 ohms ground resistance would have an outage rate from lightning of about 0.5 flashover per 100 miles per year. Sixteen insulators have a critical impulse strength of 1,450 kv crest. Assuming 230-kv operation and one line conductor at maximum crest voltage to ground at time of flashover, crest voltage is 187 kv. This value, deducted from 1,450 kv, leaves 1,263 kv as the permissible voltage developed across the insulator string by a lightning stroke.

Flashover strength required by any line for 0.5 flashover per 100 miles per year is obtained by adding its line-to-ground crest operating voltage to 1,263 kv. For this new surge voltage, the number of insulators can be obtained from a curve of insulator impulse strength. While this is an approximate method, its results check with other methods of obtaining the number of insulators as a function of operating voltage for a given lightning outage rate.

Contamination Sets EHV Insulation . . . Fig 2 shows the number of insulators required at different voltages, dictated by normal voltage with allowance for contamination, switching surges, and lightning. Curves derived by the preceding method are included, and the normal voltage-contamination curve includes allowance for switching surges. The suggested line insulation curve points up the fact that at 230 kv and below, insulation is fixed primarily by lightning considerations. Above 230 kv, the principal factor appears to be contamination.

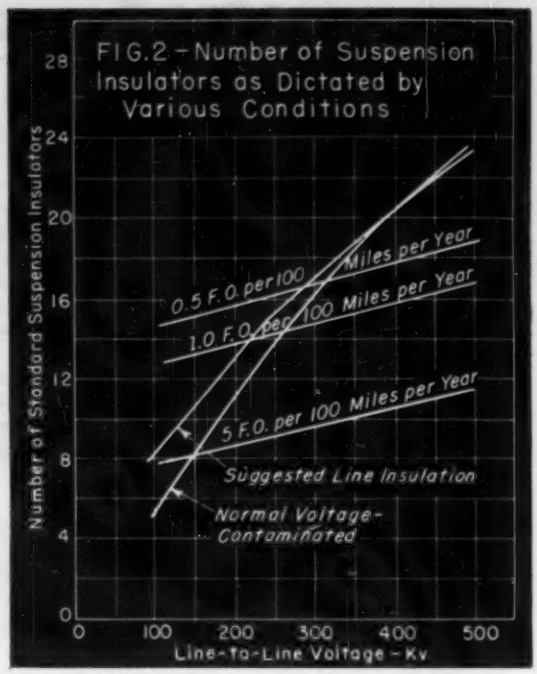
This reasoning provides the following figures:

Kv	Units	Kv	Units
138	10	360	20
230	15	400	21
287	17	440	22
330	19		

EHV Gives High Capabilities . . . Long lines (300 miles) can be operated with stability at 1.0 SIL. Shorter lines can be operated at much heavier loadings, although reactive kvar control usually limits loadings to 2.0 SIL or less. Possible circuit loadings are given in the following table, where for uniformity the surge impedance loading of a bundle-conductor line has been taken as 125% of that of a single-conductor line, although the exact amount may be greater or less:

	Capability of One Circuit			
	SIL 1.0		SIL 1.4	
Circuit Kv	Single	Bundled	Single	Bundled
230	132	165	185	231
287	206	257	288	360
330	272	340	382	476
360	324	405	454	567
400	400	500	560	700
440	484	605	678	844

Some figures seem completely impracticable because of the consequences of tripping a line carrying such load. But here are reasons for supposing that objections to high line capabilities are more customary than factual:



1. Annual availability of EHV lines will probably exceed all other major elements of the system except transformers and circuit breakers.

2. Tripouts from all causes will probably be fewer than 1 per 100 miles per year, and automatic high-speed reclosing will reduce actual forced outages to a much lower figure.

3. Single generating units of 350,000 kva are already on order and the ultimate is not yet in sight. This kva is already half of the heaviest line loading for 1.0 SIL.

4. Short-time overload capabilities of transmission are almost unlimited for short lines so that circuits in parallel to a dropped line section can pick up the load until relief can be provided.

5. Considering generating capabilities when some of the present 230-kv systems were started, a number of interconnected systems are now able to absorb circuit capabilities in the 500-to-750-Mw zone.

Sleet Melting May Prove Unnecessary . . . Practically all lines in prospective sleet territory are designed for nominal ice and wind loading, and some companies provide for sleet detection and melting. Sleet preventive loading, employed by some utilities, is not considered here.

A survey of recent papers and supplemental information raises the question whether on EHV lines, designed for nominal ice and wind loading, provision for sleet melting might not be omitted as a "calculated risk." One system, keenly conscious of the sleet problems on its lines 138 kv and below, omitted sleet melting facilities on 230-kv lines and in 20 years has not experienced trouble from sleet. Its new 230-kv construction has no provision for sleet melting. Another company in one of the worst sleet storms

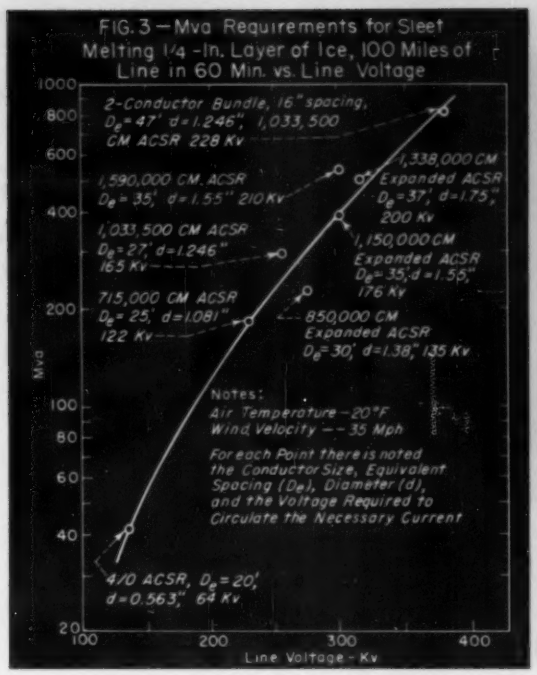


FIG. 3 — Mva Requirements for Sleet Melting 1/4 -In. Layer of Ice, 100 Miles of Line in 60 Min. vs. Line Voltage
2-Conductor Bundle, 16" spacing, De = 47' d = 1.246", 1,033,500 CM ACSR 228 Kv
1,590,000 CM. ACSR De = 35' d = 1.55" 210 Kv
1,033,500 CM ACSR De = 27' d = 1.246" 165 Kv
715,000 CM ACSR De = 25' d = 1.081" 122 Kv
1,338,000 CM Expanded ACSR De = 37' d = 1.75" 200 Kv
1,150,000 CM Expanded ACSR De = 35' d = 1.55" 176 Kv
850,000 CM Expanded ACSR De = 30' d = 1.38" 135 Kv
Notes:
Air Temperature — 20°F
Wind Velocity — 35 Mph
For each Point there is noted the Conductor Size, Equivalent Spacing (De), Diameter (d), and the Voltage Required to Circulate the Necessary Current
4/0 ACSR, De = 20', d = 0.563", 64 Kv
Mva
Line Voltage - Kv

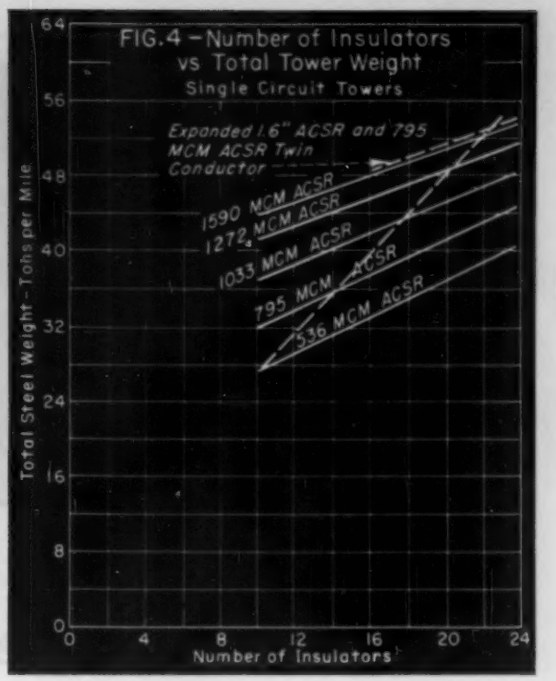


FIG. 4 — Number of Insulators vs Total Tower Weight
Single Circuit Towers
Exponded 1.6" ACSR and 795 MCM ACSR Twin Conductor
1590 MCM ACSR
1272 MCM ACSR
1033 MCM ACSR
795 MCM ACSR
536 MCM ACSR
Total Steel Weight - Tons per Mile
Number of Insulators

in its history suffered outages ranging to several days on distribution and subtransmission while its 138 and 230-kv systems remained intact. Perhaps the generally higher quality and heavier construction of EHV lines inherently provide a tolerable degree of immunity.

As transmission voltages rise, sleet melting and prevention become almost prohibitive. Circles in Fig 3 were calculated from formulas given by J. E. Clem in "Currents Required to Remove Conductor Sleet" (EW, Dec. 6, 1930, p 1053). Air temperature was taken as 20F, wind velocity 35 mph, sleet thickness ¼ in., and melting time 60 min. Line voltage and conductor size were correlated from curves in the Harder and Clayton paper previously cited. The general law seems to be that kva required per unit length varies as the cube of voltage. By rough approximation, then, the kva required for sleet melting on a 230-kv line is 200,000 kva per 100 miles.

Extrapolating as the cube to 460 kv shows 1,600,000 kva to melt sleet on a 100-mile length of line. Such values are almost prohibitive, particularly because they must be available at intermediate voltages. Accordingly sleet melting may well be one of the most restrictive factors in placing a ceiling on transmission voltage. This question must be weighed carefully to determine whether accumulated data at 230 kv and below really warrant design for sleet melting. Such consideration should not overlook the ground wires from which sleet cannot be removed by circulation of current.

EHV Economics Complex . . . Many factors enter into EHV transmission economics. Among them are:

1. Tower costs, including footings and erection.
2. Conductor costs, including stringing.
3. Capitalized losses.
4. Accessories (insulators, ground wires, miscellaneous hardware).
5. Rights-of-way.
6. Engineering and supervision.

Of these, the most important in voltage comparisons is tower cost. Most other factors can be determined with relative ease for different voltages if they can be determined fairly accurately for any one voltage.

When cost studies are made for only one voltage, line costs can be determined for several different tower designs with several strengths of each to allow for various span lengths and conductor sizes. When a voltage range is also considered the procedure is extremely time consuming. Not only must many towers be designed and evaluated, but the designer cannot be certain that discrepancies do not unfairly favor a particular voltage. A method is needed for obtaining tower costs more easily and providing "smooth curve" relationships among the factors.

Tower Weight Controlling Factor . . . The controlling factor in tower costs is tower weight. Study of many cases shows that total tower cost is directly proportional to weight of steel. W. S. Peterson ("A Formula for Estimating Tower Weights and Its Application to the Economics of Transmission Line Design," Paper No. 218, CIGRE 1950 Session, Paris) has developed a formula giving tower weight as a function of tower heights and unbalanced pull.

Tower height is determinable from clearances to ground, number of insulators, and conductor sag. Unbalanced pull is a function of the conductor tensions and distance from tower center line. With any given conductor and number of line insulators, Peterson's formula gives a means of estimating tower weights and hence costs. Numerous spot checks of this formula indicate that it gives reasonably accurate results. Any errors would probably be in absolute rather than in relative costs. Its primary use is

(*Continued on page* 202)

Turning Irate Customers Into Friendly Boosters Stresses . . .

Personal Contacts in Good PR

Alfred M. Cooper, Indio, Calif.

The responsibility of the utility executive for improving public relations toward his company does not end with the training of contact employees nor the making of addresses before local civic groups. These things are helpful. But the day-by-day meeting of this head man with consumers, friendly or antagonistic, is of even greater value as a public relations builder.

Recently, I called on an operating superintendent as he was smilingly bidding goodbye to a visitor.

"Man!" he said to me a few minutes later, "you should have seen that fellow a half hour ago. Was he mad!"

It seemed that line gangs in trying out an insulator-washing tower had sprayed some of the dirty liquid chemical over washing hung out to dry on an adjacent rooftop.

"When this fellow made a complaint about his wife's ruined wash somebody here brushed him off. Naturally that made him furious, and luckily he insisted on going to the top. I like to handle those tough cases.

"There's only one way to handle a fellow who's mad," explained the superintendent. "I encourage him to get it all off his chest. Not until he had about run down did I attempt to excuse the incident and assure the man we would pay for the ruined clothes."

These important contacts between public and executives generally fall into one of four groups.

1. Telephone Contacts. The busy and often harassed executive may answer his phone in a manner not calculated to win friends, yet be wholly unaware that his voice grates harshly on the ear at the other end. He may pick up the phone and say "Yes. Yes. This is Jones. What is it?" Immediately the caller senses the impatience. Or the executive may prod a caller who is slow in making his point—another cause of dissatisfaction.

The most frequent complaint about calls between executives of different corporations is against the man who has his secretary put through the call and then keeps the party at the other end hanging on until he is ready to pick up the handset. Despite the publicity that has been given to this single act of discourtesy, you will still hear bitter complaints about it all too often.

LINE CREWS sprayed liquid chemical over his wife's laundry hung out to dry

2. Telephone Interruptions. An important consumer is visiting an official of a power company. The phone rings and the executive answers. After listening a moment he says, "O. K. John. I'm busy, but I'll be through here in a couple of minutes."

This is probably the first intimation the important consumer has had that his interview is about to be terminated "in a couple of minutes."

This situation can be avoided by such answers as: "I'm busy now, John. Let me call you back;" or, if the call is from the boss, saying "Just a moment, Mr. Blank," and then to the visitor, "the boss wants to see me right away. Can we finish this discussion later?"

Thus consulted, the visitor is glad to cooperate, no feelings are hurt, and the boss has not been delayed.

3. The Undesirable Interview. This is a difficult problem familiar to most executives. Methods of handling it vary from the foot push-button under the desk which brings the secretary in

(*Continued on page* 206)

SYSTEM ENGINEERING—Communications

Dialing two digits on a telephone-type dial and pressing a pushbutton sets up an automatic control unit that . . .

Operates Microwave Repeater Remotely

ROBERT ELEY
BEVAN JONES, Southern California Edison Co, Alhambra, Calif.

Remote control of selected functions at a remote microwave repeater station from the system communications center provides operating advantages for Southern California Edison Co. The remote control unit, designed and built by the authors, makes these functions possible:

1. Operation of the automatic switchover system for RF equipment from normal to standby and back to normal. Formerly, the return from standby to normal had to be done manually. The automatic switchover circuit also can be by-passed.

2. Isolation of any one of six legs of a party-line microwave system. In the past, if one leg was operating improperly, the trouble communicated to the other legs and produced sub-standard operation on all of them.

3. Switching of the RF equipment onto standby and back to normal to increase the operating life of the equipment.

In addition, the following functions can be readily adapted to remote control.

1. Selective reading of metering points at the repeater station.

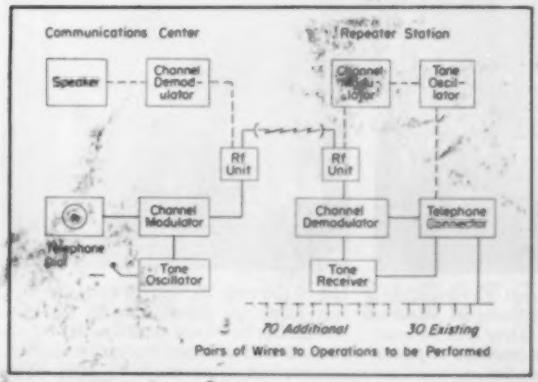
2. Control of the vhf repeater at the station.

The need for remote control grew out of the distance between the communications center and the unattended repeater station on a mountain top, about 45 microwave-miles away. However, to reach the station required a drive of about 2½ hours under the best of conditions.

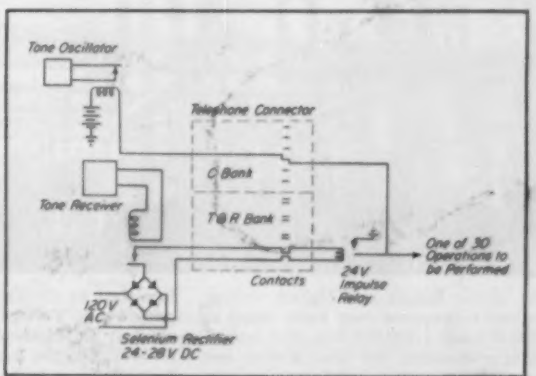
Heart of the remote control unit is a Strowager telephone connector installed at the repeater. Other standard equipment located there includes a standard audio tone receiver, an audio tone oscillator, and a channel modulator. Standard 24-v impulse relays operate the equipment to be controlled. Power is supplied by a selenium rectifier rated 120 v ac and 24-28 v dc. For greater reliability the dc supply is conservatively rated.

Equipment in the control system at the communications center includes a standard telephone dial, an audio tone oscillator, a pushbutton, a channel demodulator and a speaker. Arrangement of this equipment is shown in the accompanying block diagram. The remote control

(*Continued on page* 112)



REMOTE CONTROL SYSTEM is added to microwave channel between the communications center and a repeater station



BASIC UNIT is standard telephone connector. Operation is set up through T&R bank; signal returns through C bank

SWITCHGEAR NEWS

NEWS OF SWITCHGEAR DEVELOPMENTS OF IMPORTANCE TO THE ELECTRICAL INDUSTRY

New Analog Computer Aids G-E Switchgear Research

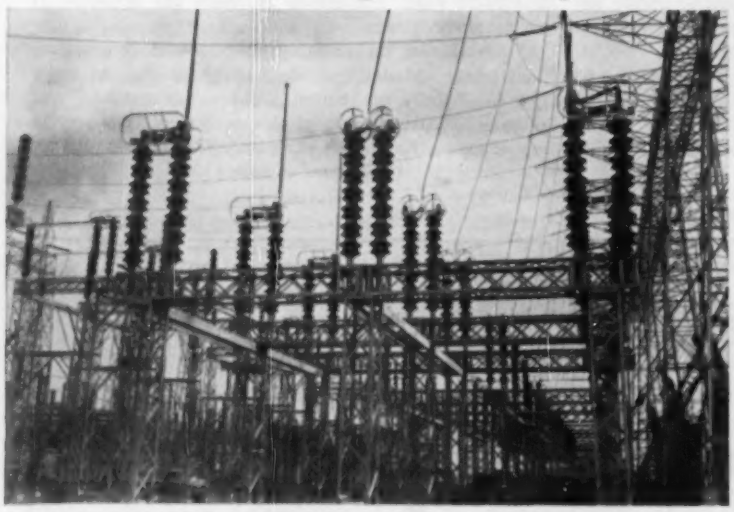
During its first year of operation the analog computer has proved to be an extremely useful tool in speeding General Electric switchgear research. Its primary function is to investigate the performance of a wide variety of mechanical systems used in G-E switchgear products. In addition to saving a great deal of time, the new computer has given G-E designers vital data unobtainable by other methods.

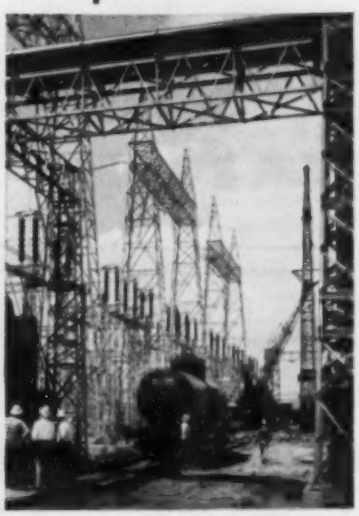
Among the important contributions made by the new computer was the verification of the design of the new high-speed distribution breaker described on the next page.

Many other problems are now under consideration which will ultimately result in improved switchgear performance. Among them is investigation of the contact bounce phenomena in the cup-type relay. Results of this study should make it possible to increase contact efficiency and life.

G.E.'s speeded-up research program has resulted in increasingly complex problems being handed to the computer. To keep up with this increasing load, new additions have been made to the original installation, until today, the computer, with a total of 12 integrators, is able to represent a six-degree-of-freedom system.

Nation's largest switchyards near completion





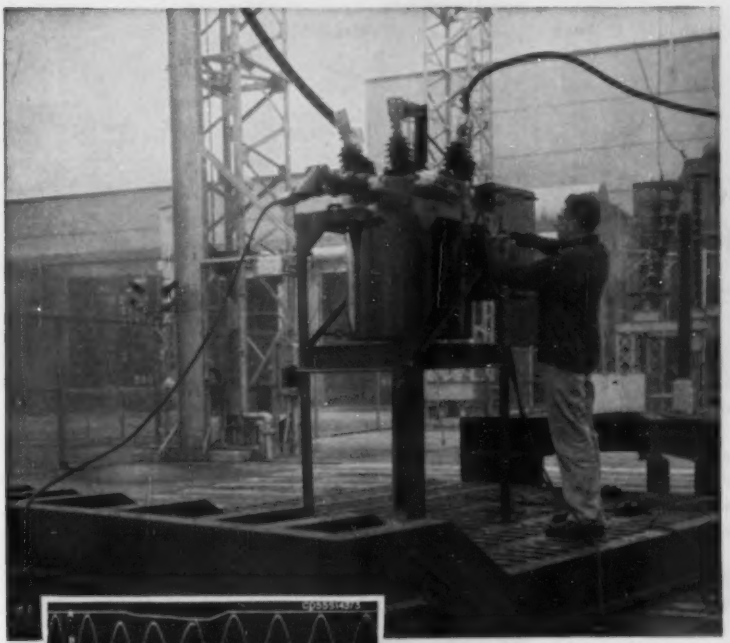
Two of the largest and highest voltage outdoor substations ever built, rated at 1,000,000 and 1,300,000 kva, each including approximately 800 tons of steel and covering approximately 13 acres, are now under construction for an important AEC project. The switching structures of the 330-kv substations were designed and furnished by the General Electric Company's High Voltage Switchgear Department at Philadelphia. They will be used for switching the large amounts of power required for a new installation.

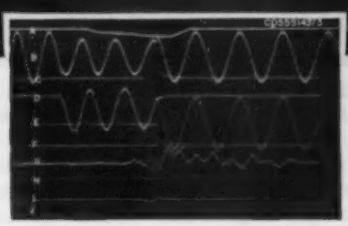
The stations utilize a total of 114 air switches rated 330 kv, along with a number of the new 25,000,000 kva interrupting capacity power circuit breakers. Aluminum buses are used throughout the stations and designed to carry a continuous current of as much as 2000 amps. More than 4000 strain insulators and 6000 bus and switch insulators were required for each station.

General Electric announces . . .

NEW 5-cycle distribution breaker

High-speed Interruption Minimizes Chance of Line Burn-down, Offers Closer Co-ordination of Fuses





New breaker has been subjected to extensive full scale power and capacitance switching tests at G-E Development Laboratory. Oscillograms consistently show better than 5-cycle interruption.

A new oil power circuit breaker for distribution system application is now in production at General Electric's High Voltage Switchgear plant in Philadelphia.

Rated to interrupt distribution loads in 5 cycles at 14.4 kv, the new breaker offers distribution engineers the opportunity of increasing transformer sizes to meet load growth without need for changing to a heavier wire system.

On systems using 1/0 wire, for example, the new breaker would permit transformer capacities to be increased 68% over burn-down values considered safe for the standard 8-cycle breakers now in use. Faster interruption will also enable better fuse protection of distribution equipment because smaller ratings of co-ordinated fuses may be applied.

To achieve smooth, positive closing, G-E engineers teamed a stored-energy torsion spring with a low-impact cam-drive mechanism. The mechanism is both mechanically and electrically trip-free and can provide instantaneous initial reclosing even if closing power supply is unavailable.

Powered by a 400-watt universal motor, the spring charged mechanism eliminates the need for heavy closing power supply sources normally required with distribution breakers.

The new, stronger cylindrical tank breaker requires 26% less station space than did the previous square tank breakers. Six bayonet type interrupters are incorporated in the single-tank construction.

The higher-speed 5-cycle breaker supersedes G.E.'s 8-cycle Type FLO breaker and is being introduced at no increase in price.

For further information, see your General Electric representative, or complete the bulletin-request coupon on this page.

Progress Is Our Most Important Product

GENERAL ELECTRIC

SECTION C 491-1
GENERAL ELECTRIC COMPANY
SCHENECTADY 5, NEW YORK

Please send me the following bulletins:
☐GEA-6295 New 5-cycle Distribution Breaker
☐GEA-5961 Impulse Oil Circuit Breakers (138-300-kv)

Name .....
Company .....
Street .....
City ..... Zone ..... State .....

Remote Control for Microwave

(*Continued from page* 109)

equipment uses an unoccupied channel from the center to the repeater. The return channel is used as an alarm transmitter channel in the original equipment supplied by the manufacturer. Cost of additional equipment for the remote control scheme is estimated at $350.

This scheme could be applied to any type of microwave system by using a voice channel with signalling facilities. Briefly, this is how remote control is exercised. The operation to be performed is dialed with a two-digit number at the communications center. This sets up the telephone connector through the T&R bank for the operation. With the pushbutton, a tone is transmitted over the microwave channel that energizes the tone receiver. The resulting signal closes a relay that performs the desired operation.

At the same time, the circuit through the C bank of the connector energizes the tone oscillator. This transmits a tone back to the speaker at the center to indicate operation.

Remote switching of RF equipment at the repeater onto standby is most desirable. Experience has shown the standby equipment will suffer loss of operating life if it is not used. Specifically, the transmitting and oscillating tubes have shown early failure, while working them hot prolongs their life.

Furthermore, remote switching provides a check on operating conditions at a time when the equipment is not needed for uninterrupted operation of the repeater. And remote control saves a trip to the station. The standard switchover equipment at the repeater will not return to normal auomatically after being switched to standby. Under present plans, only 30 of the existing 100 pairs of connections in the telephone connector are used. Additional operations under consideration would be handled by these unused pairs.

SUBSTATIONS—Maintenance

Air and Limestone Jet Cleans Insulators Safely, Effectively

J. K. REAVES, Supt of Transmission, California Electric Power Co, San Bernardino Calif.

Removal of fine-dust contaminants from substation insulators is done more efficiently with an air-powered device that produces a jet of air and limestone. This equipment effectively removes contaminants that resist high-pressure water washing. It permits a faster and better cleaning operation than the tedious and expensive manual method of using steel wool or acid. The air-powered device may be used on energized lines without the danger of a flashover.

Use of this device was prompted by serious contamination on Calectric's lines and substations near cement plants. A fine dust prevalent in these areas settles on the tops of insulators and also is attracted electrostatically to their undersides. Alternate wetting and drying due to fog produces a cement-like material that water washing will not remove. Insulators become so heavily coated that a slight amount of moisture results in flashovers.

The air-powered device is similar in design and operation to a sand-blast machine. Air is supplied at 80 to 125 psi and 70 to 150 cfm and is filtered to remove moisture. A predetermined amount of powdered limestone is added to the air as it passes through the cleaner. The mixture is expelled through an air hose to either a straight nozzle for cleaning de-energized equipment, or through a hollow insulated tube, the hot-stick, for energized equipment.

The hollow tube is a phenolic resin, providing 75-kv/in. insulation. A 6-ft section is used for lines up to 33 kv, and 8-ft piece up to 100 kv. A ⅛-in. nozzle opening is the most effective for average work. The threaded tube is reduced with pipe fittings to two ⅛-in. street ells for adjustment to any angle. Best results are obtained when the nozzle is held 4 to 6 in. from the work.

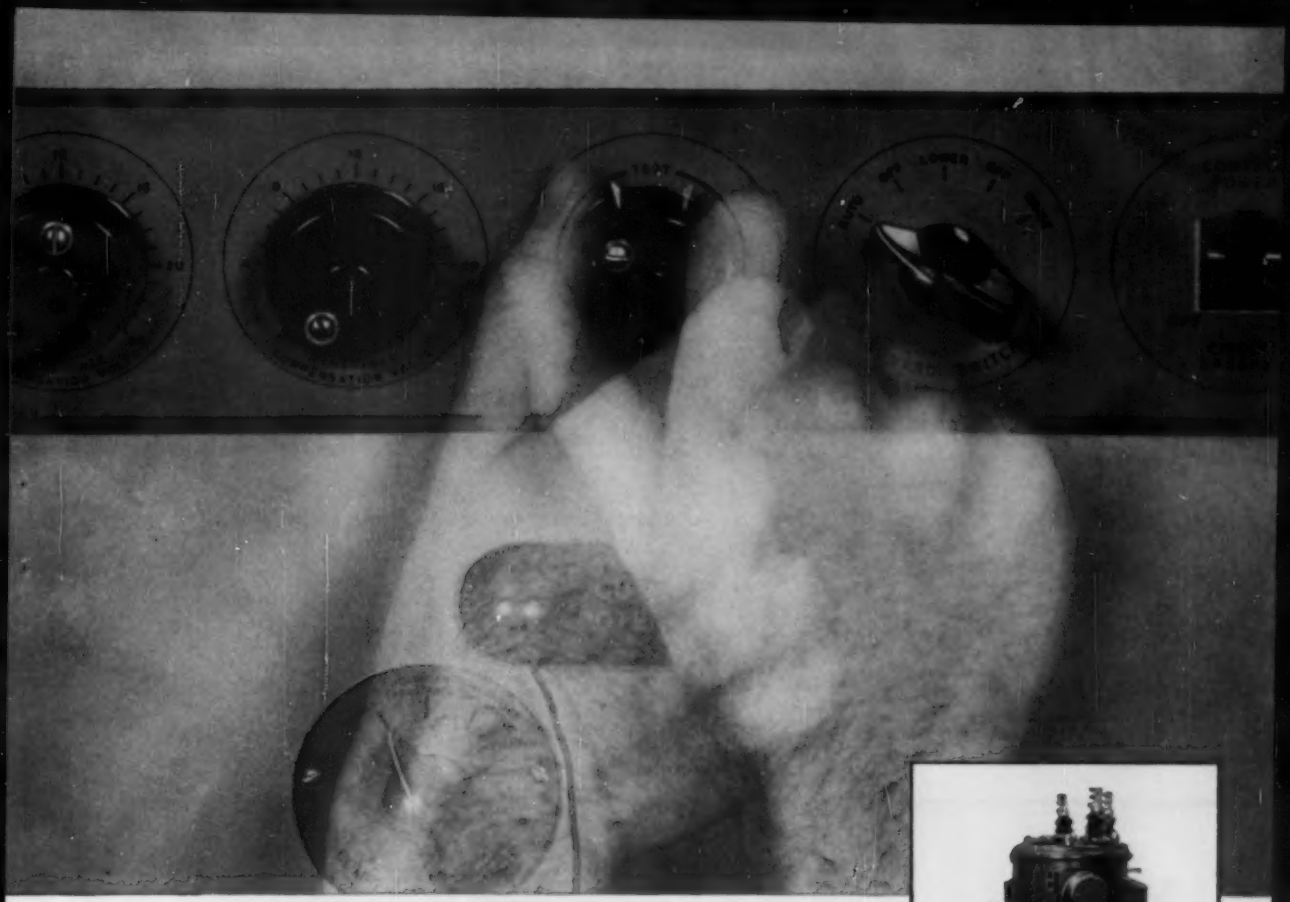
By experimentation the developers determined that limestone ground to 80 mesh was an ideal cleaning compound. Limestone is plentiful, fairly soft, and as a fine powder will not damage insulator glaze. Although 50 mesh will cut much faster, it will burn or cut the glaze if held in one position.

AIR-POWERED TOOL produces jet of air and powdered limestone to remove cement coating that resists washing

Acceptance tests were made to insure that no danger existed to operating personnel while cleaning energized equipment. With a section of the hot stick packed with the cleaning compound, break-down tests were made by applying 100 kv across a 4-ft piece. The distance between probes was reduced gradually. No leakage was measured on the tube surface or through the limestone down to a distance of 4 in. At this distance an air flashover occurred. This test indicated a safety valve equal to ordinary hot sticks.

Actual cleaning operations have proven the value of

(*Continued on page* 118)



DO YOUR STEP REGULATORS GIVE YOU

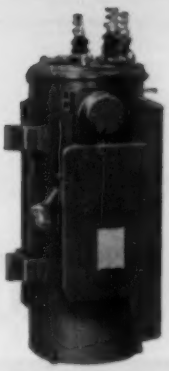
"Micro fine" relay testing for quick, accurate adjustments

It's *another* important General Electric voltage regulator feature to give you unexcelled regulating accuracy. The "micro fine" relay test rheostat is the fastest way yet of getting the right voltage you need to adjust the voltage regulating relay.

There's no juggling between the increments of step-to-step voltage output . . . no compromising with the exact setting. Just one twist . . . a little more or less series resistance . . . and you get a micrometer-accurate voltage adjustment on the relay. Or, compared to testing with externally wired-in equipment, you save about 15 minutes set-up time. All of G.E.'s step voltage regulators have this important "micro fine" adjustment feature.

12 more features in G.E.'s 1955 line of step feeder voltage regulators give you greater accuracy, longer life, superior service. They add up to the most advanced line of step regulators available today. General Electric Company, Schenectady 5, New York.

423-7



ONLY G-E STEPS HAVE ALL THESE FEATURES

Greater Accuracy

- Class 1 Control Accuracy
- Control Dial Locking
- Control Test Rheostat
- Rheostats for LDC Adjustments

Longer Life

- Opti-Life Tap Switching
- One-Piece Cover Band
- Super-Melaglyp Paint
- Nitrile Rubber Gaskets
- Electrostatic Shielding

Superior Service

- Flat Upper VRR Contacts
- Up to 120-Sec. Time Delay
- Handy Meter Shelf
- Internal By-Pass Protection

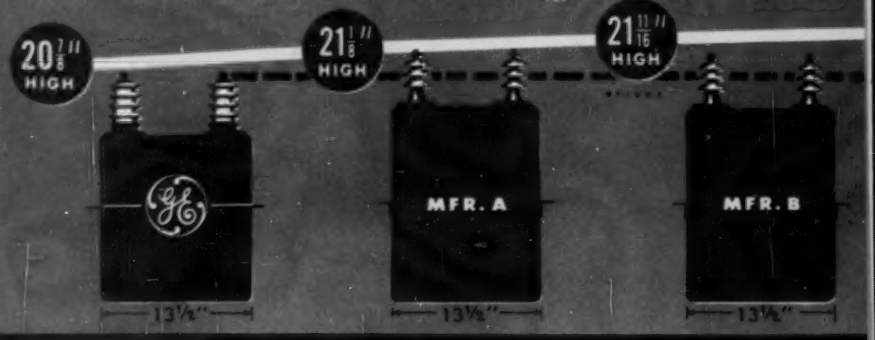
Progress Is Our Most Important Product

GENERAL ELECTRIC

Engineered Extras

at no extra cost

COMPARISON OF 25 KVAR CAPACITORS

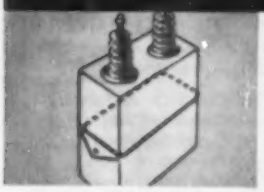


COMPARISON CHART and figures show the relative size and weights of 25-kvar capacitors made by General Electric and six other manufacturers. You see at a glance that General Electric capacitors are the smallest and lightest you can buy.

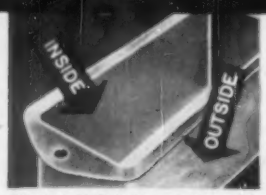
APPROX. WEIGHT		
2400V UNIT	63 lbs.	
7200V UNIT	71 lbs.	
APPROX. WEIGHT		
2400V UNIT	72 lbs.	
7200V UNIT	79 lbs.	
APPROX. WEIGHT		
2400V UNIT	78 lbs.	
7200V UNIT	79½ lbs.	

General Electric Capacitors

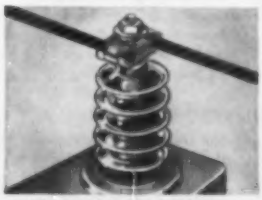
ONLY G-E CAPACITORS HAVE ALL THESE Engineered Extras AT NO EXTRA COST



SHORT RESISTANCE WELD around middle of case produces strong, neat seam.

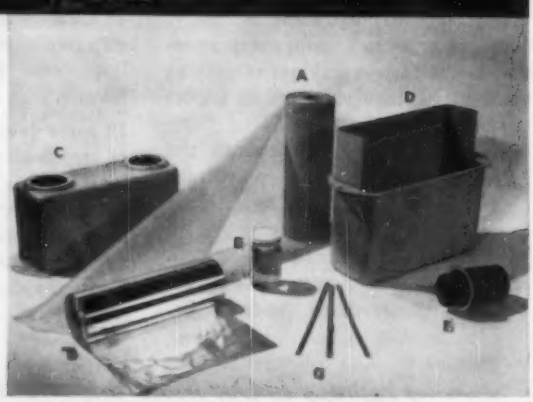


CASE TIN-PLATED inside and outside for better protection against corrosion.

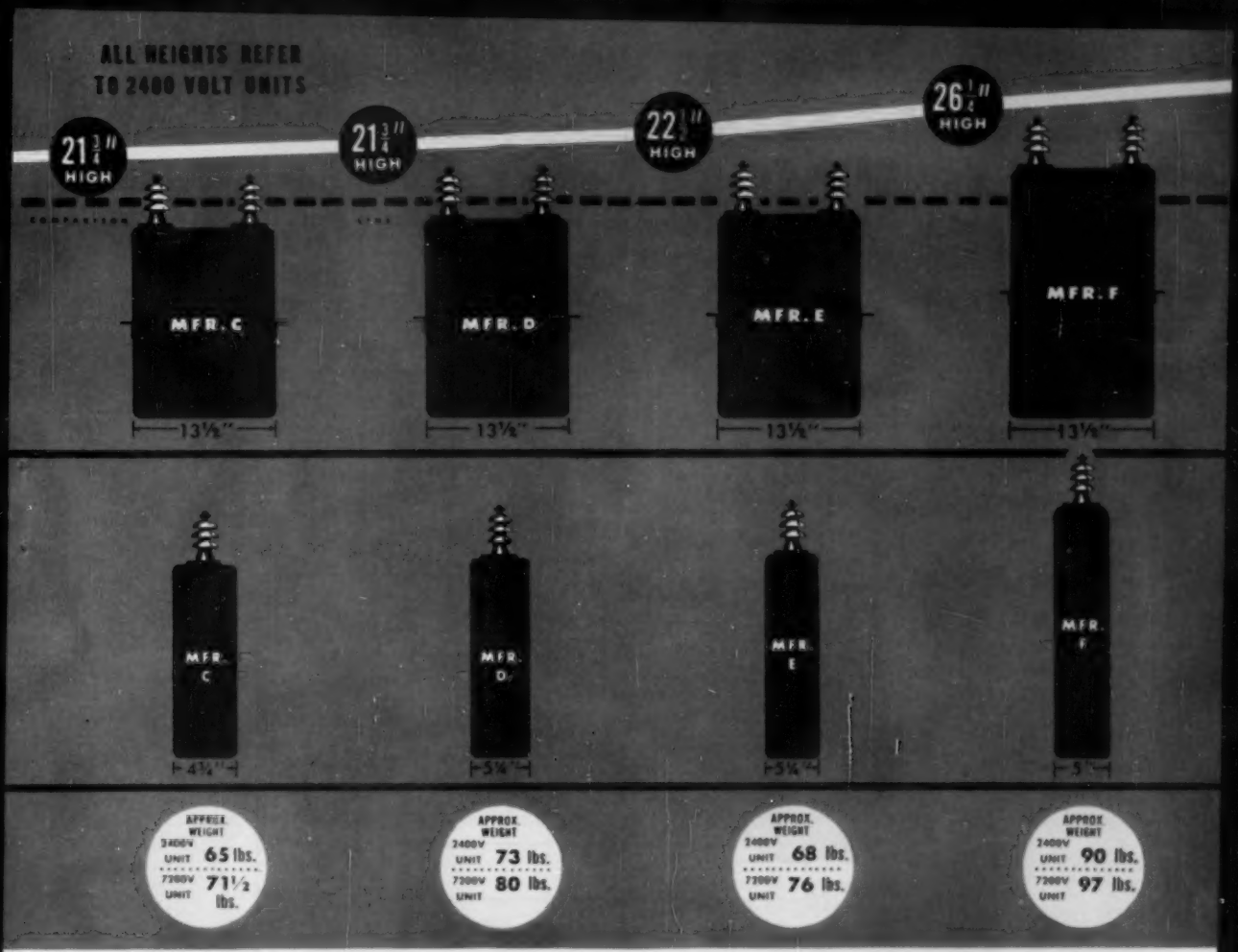


NEW TERMINAL ASSEMBLY with Belleville washers gives lasting contact pressure.

MOUNTED IN ANY POSITION, G-E capacitors maintain uniformly high efficiency.



THESE EXTRA QUALITY COMPONENTS enable General Electric to make the smallest and lightest capacitor: Low-loss kraft paper (A); dead-soft annealed aluminum foil (B); deep-drawn case (C); molded major insulation (D); high dielectric Pyranol (E); cast glass bushing (F); pure aluminum tap straps (G).



are smallest and lightest

Finest components, rigid quality control make more compact, easier-to-handle units

Extra quality components like low-loss kraft paper, dead-soft annealed aluminum foil and high dielectric Pyranol*—rigidly controlled by thorough testing—result in more capacitance per unit volume. The deep-drawn steel shells with rounded corners permit major insulation to conform to the shape of the case for more efficient heat transfer and further space saving. Result: the smallest, lightest capacitor on the market.

Extra ease in storage and handling result from General Electric's light weight, compact design. And, these smaller lighter capacitors produce neater looking installations that create less strain on your crossarms and poles.

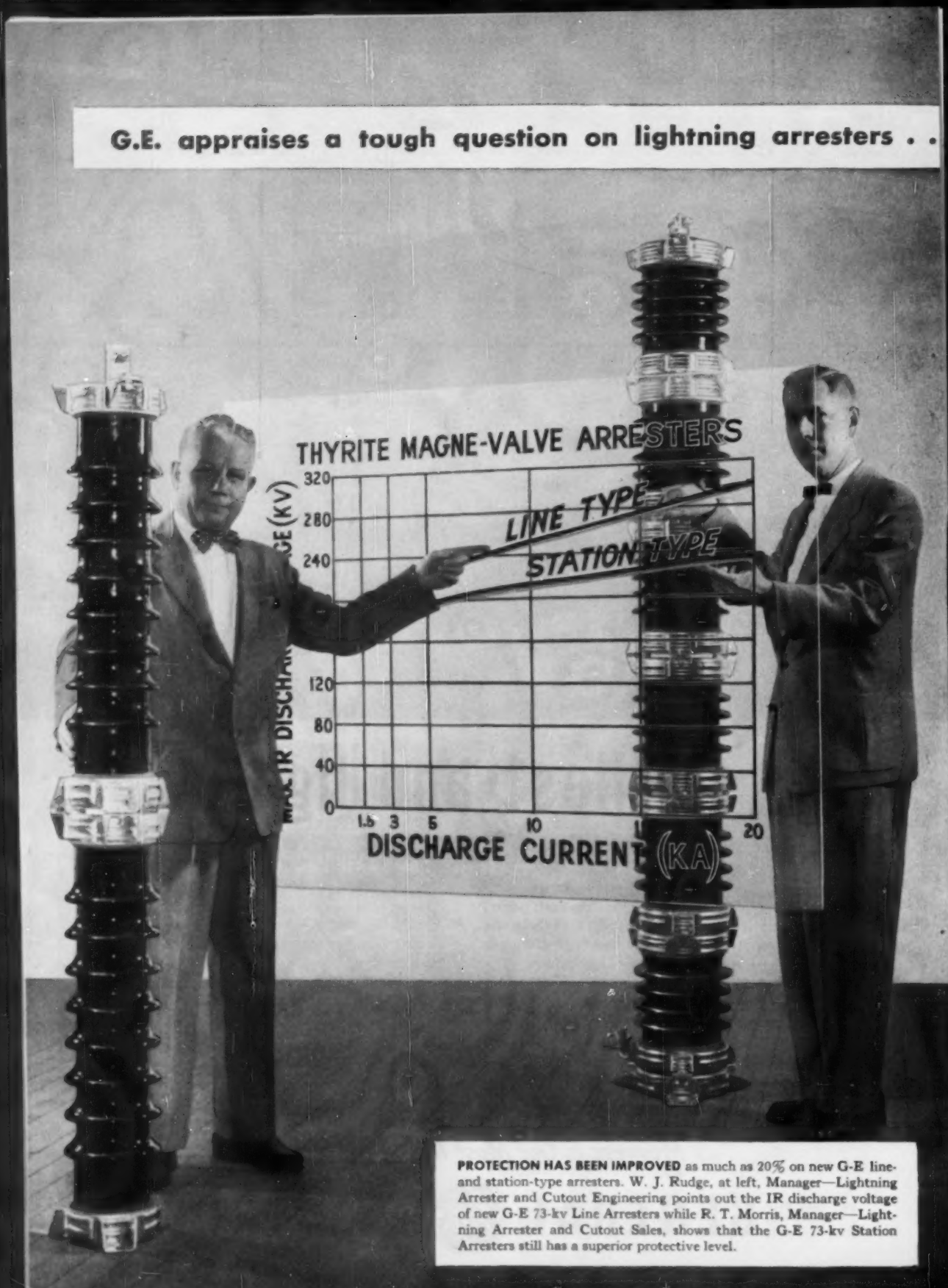
These are but a few of the Engineered Extras found in General Electric Capacitors. They are good reasons why you get the most value from G.E. For more information, contact your G-E Apparatus Sales Representative or write General Electric Company, Schenectady 5, New York. 441-23

*Reg. trade-mark of General Electric Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC

G.E. appraises a tough question on lightning arresters . .



PROTECTION HAS BEEN IMPROVED as much as 20% on new G-E line- and station-type arresters. W. J. Rudge, at left, Manager—Lightning Arrester and Cutout Engineering points out the IR discharge voltage of new G-E 73-kv Line Arresters while R. T. Morris, Manager—Lightning Arrester and Cutout Sales, shows that the G-E 73-kv Station Arresters still has a superior protective level.

. . . . . LINE OR STATION . . .

WHICH SHOULD YOU CHOOSE?

Which is better for your application, line or station arresters? Now that General Electric has made major design improvements in both types, the right answer to this question gains new importance.

THE CHOICE IS YOURS. G.E. makes both types. Although there isn't any black-and-white solution that can be applied everywhere, there are some clear-cut applications for each, depending upon the economics and engineering involved.

SUGGESTED APPLICATION GUIDE. To help you strike a balance between the best degree of lightning protection and the lowest possible cost, General Electric makes these suggestions.

G-E Station-type arresters are generally preferred for:

1. Locations where size and importance of apparatus demand the best in protection for uninterrupted service-continuity.
2. Transformers or other apparatus having reduced insulation and rotating a-c machines, 2400 volts and above.
3. High-voltage lines subject to severe switching surges.
4. Cable systems or large KVAR capacitor banks that require maximum arrester discharge capacity.
5. Transformers in severe lightning localities or connected to lines with no overhead ground wire, or highly insulated wood pole lines, or locations where close arrester coupling is not possible.

G-E Line-type arresters are generally preferred for:

1. The protection of smaller or what is considered less important apparatus.
2. Locations where space requirements for station arresters are not available, for example, certain metal-clad equipments and mobile substations.
3. Protection of switching substations containing breakers, air-break switches, etc.
4. Protection of low voltage side of transformer substations, where line-type arresters are already used on high voltage side.

WHICHEVER YOU CHOOSE, line or station, remember that now you get as much as *20% more protection* in both types. The reason—a design combination of improved Thyrite valve disks and exclusive Magne-Valve series-gap.

NEED MORE HELP? The data chart below shows you the comparative characteristics of G.E.'s new station-type and line-type arresters. An application engineer from your local G-E Sales Office will be glad to assist you. Or write to General Electric Company, Schenectady 5, New York—ask for Bulletin GEA-1304 (Station Arresters) or Bulletin GEA-2978 (Line Arresters).

432-14

COMPARATIVE DATA

THYRITE® MAGNE-VALVE	STATION-TYPE	LINE-TYPE
DISCHARGE CAPACITY		
HIGH CURRENT 5 X 10 μs wave, 2 discharges	150,000 A	100,000 A
LONG DURATION 2000 μs rectangular wave, 20 discharges	650 A	200 A
DUTY CYCLE (10 X 20 μs wave initiating impulses, 20 operations, full rated voltage during flow of follow current)	20,000 A	10,000 A
RELATIVE VOLTAGE STRESS ON PROTECTED APPARATUS	100%	120%*

*(Average—Exact Ratio Depends on Discharge Current) ® Registered Trade-mark G.E. Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Cleaning Insulators Safely

(*Continued from page* 112)

this new equipment. It has been used on a 34.5-kv double-bus switch rack containing some 700 pin-type insulators, 54 oil circuit breaker bushings, and lightning arrester stacks. Two men did the job in 25 working days. About 75% of the work was done with equipment de-energized. Had the work been done manually, it would have taken two men 80 to 90 working days and all equipment would have had to be de-energized.

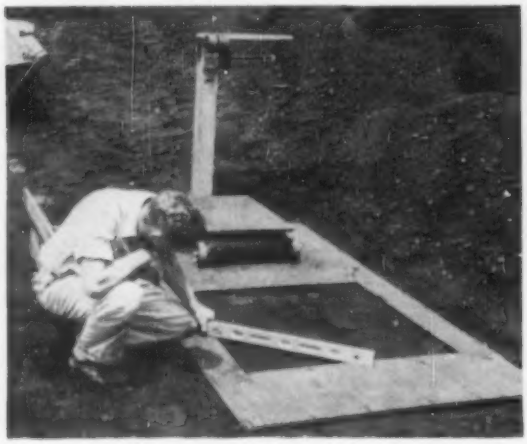
During a substation rebuild and reinsulation job, 1,000 10-in. suspension insulators were found heavily coated with a mixture of hydrocarbons and cement dust. By working with the insulators on the ground, one man cleaned an average of 100 units per day.

Pin-type insulators on a 34.5-kv line serving a cement plant are cleaned twice a year. Scheduled outages for manual insulator cleaning were minimized by concentrating all available linemen on this work with two men to a pole. The time per pole averaged one hour. Using the air-powered equipment one climber averaged 30 min per pole with the line energized.

Transformer bushings, oil circuit breaker bushings, and some 69-kv suspension insulators also have been cleaned, all at a savings over the laborious hand method.

A better cleaning job can be done if equipment is de-energized. There is considerable advantage to working with a nozzle held in the hand rather than on the end of a 6 or 8-ft piece of tubing. The dry method has been considered for all lines that require hot washing, particularly 34-kv lines with pin-type insulators. However, it is rather slow compared to water washing.

GENERATION—Operation



LEVELING COAL surface is the first step in new method

HOLE DIMENSIONS are needed for calculating volume

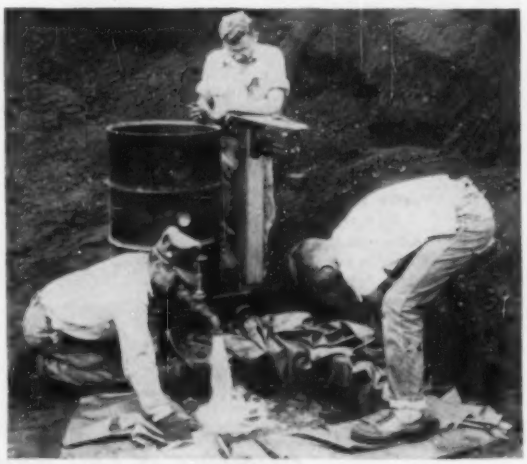
Accurate Testing Method Gives Coal Pile Data Faster

A new method for determining the density of coal piles is being tried at Niagara Mohawk Power Corp's Dunkirk plant. It involves a comparison between volumes and weights of coal and water. Results thus far indicate that the method enables technicians to make up to three tests in less time than was required to do one with the former method. Moreover, the water method is more accurate.

In the method, the coal surface on a patch of the pile is leveled, and a plywood flat having a 3-ft square hole is placed on the surface. A hole about 4 ft deep is then dug and measured. The coal removed is weighed.

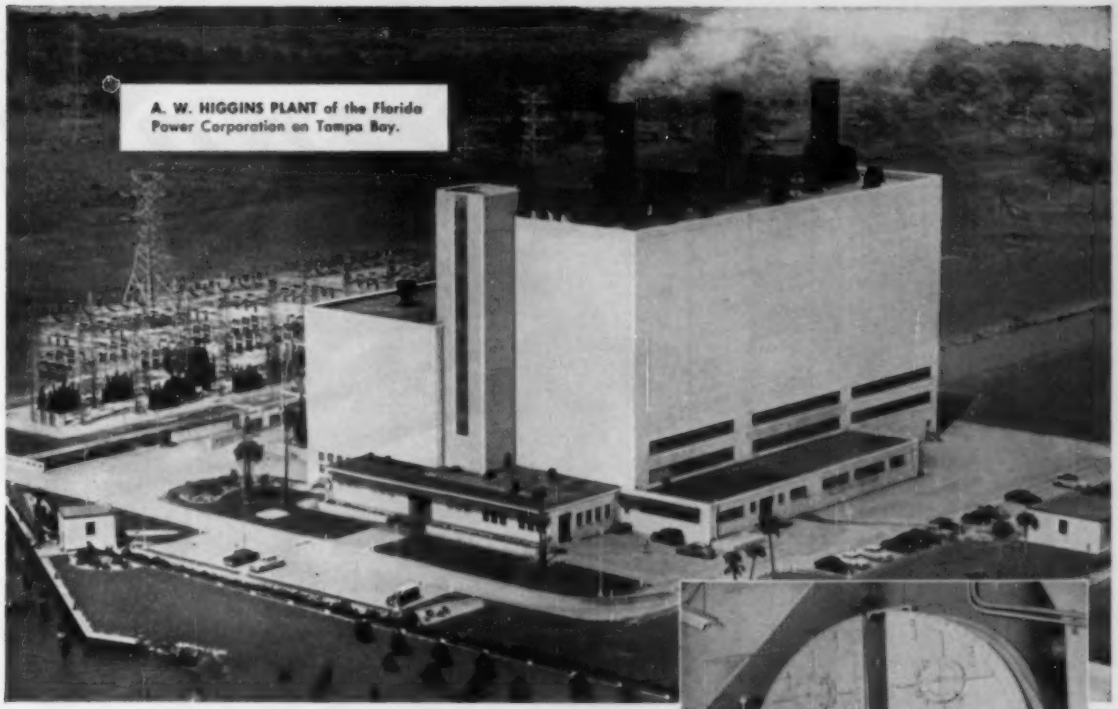
A plastic blanket is used to completely line the test hole, after which the hole is filled with water. By weighing the water of known temperature, with the scale, the volume of the hole is determined. Comparing this volume with the weight of the coal removed gives the density of the coal at that location.

When a test is completed, the plastic blanket and equipment are removed, and the crew moves to another spot.



FILLING blanket-lined hole with water of known temperature and weight provides data for figuring coal density

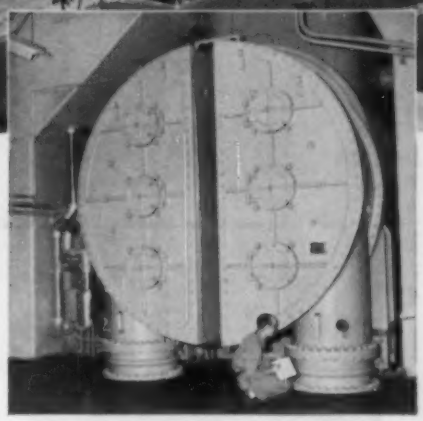
(*More How To on page* 122)



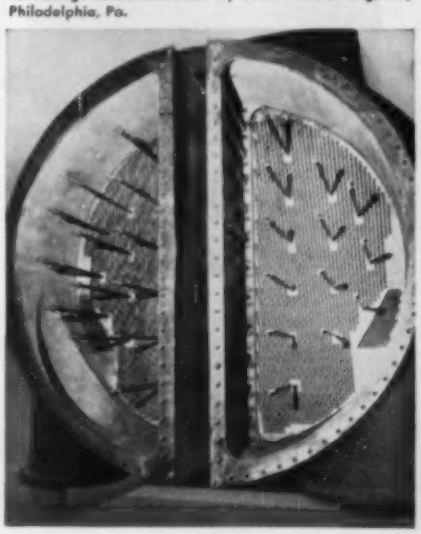
A. W. HIGGINS PLANT of the Florida Power Corporation on Tampa Bay.

REVERE 10% CUPRO-NICKEL SOLVES CORROSION PROBLEM FOR FLORIDA POWER CORPORATION

About six years ago the Florida Power Corporation was experiencing condenser tube failure at its Bayboro plant in St. Petersburg. Revere's Technical Advisory Service was called in, and recommended replacing the failed tubes with 10% Cupro-Nickel, which has a marked resistance to corrosion from brackish water. This recommendation proved successful. As a result, when Florida Power planned to add a new 135,000 KW plant, named after A. W. Higgins, Revere 10% Cupro-Nickel tubes were specified. All three units in the new plant are thus tubed. The tubes are $\frac{7}{8}$" OD x 18 BWG, 24' 7" long. A few spares are kept on hand for possible replacement, but with regular cleaning to remove debris (small bits of shell, etc.), the tube life has been exceptional, thus adding to economy of operation and increased service to a fast-growing area. . . . If you have questions regarding condenser tube selection and service, get in touch with the nearest Revere Sales Office. Remember to specify Revere.



Exterior view of one of the condensers in the Higgins plant, and below, one of the three condensers ready for tubing. Condensers made by C. H. Wheeler Mfg. Co., Philadelphia, Pa.



REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N.Y.

Sales Offices in Principal Cities, Distributors Everywhere.

Carry

Field-Proved Mechanism

You get a time-tested mechanism in Allis-Chalmers distribution regulators. For more than twenty years, in thousands of applications, this mechanism design has proved itself as the most efficient means of changing taps under load. Laboratory tests show it can withstand over 5 million operations — equivalent to more than a century of operation.

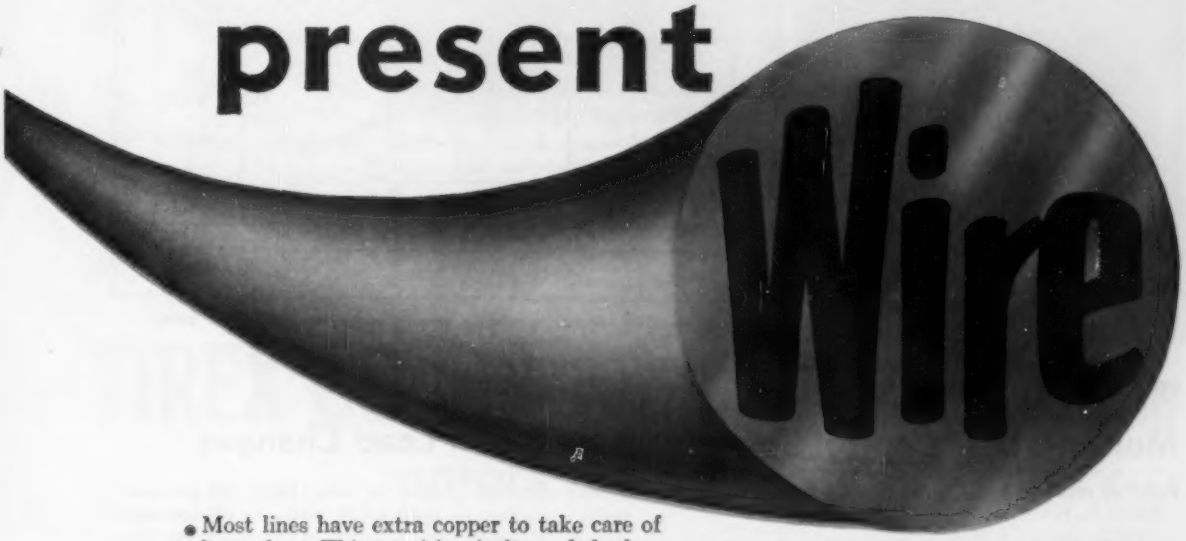
Long-Life Contacts

An important reason why you get satisfactory regulation with a minimum of trouble from A-C distribution regulators is their long-life contacts. Made of arc-resisting materials, contacts are of large size. Laboratory tests prove that they can stand up under the equivalent of forty years of normal operation.

AC ALLIS-CHALMERS

ALLIS-

double loads with present Wire



• Most lines have extra copper to take care of voltage drop. This provision isn't needed when Allis-Chalmers distribution regulators control voltage automatically. Here's why:

Doubling loads also doubles voltage drop. On a line with 10% voltage drop, for example, doubling the load makes the voltage drop 20%. You can retain the 100% increase in load to serve more customers while bringing the voltage drop back to 10% with an Allis-Chalmers regulator. Its ± 10% range makes increasing loads easy.

All the equipment you buy is Allis-Chalmers distribution regulators. No wire to buy, no expensive labor charges. And at the same time you get close voltage control, which gives you higher revenue, cuts voltage complaints.

Get all the facts on Allis-Chalmers distribution regulators. Call your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wis.

Unit Construction

You get assurance of years of satisfactory service from A-C distribution regulators, as a result of unit construction. All connections are made and thoroughly inspected before tanking — assuring top-quality workmanship. Same feature makes untanking easy: core, coils, cover, and control form a single unit.

Simplified Maintenance

You don't need highly trained servicemen to handle Allis-Chalmers distribution regulators. Take the control, for example. It is simple. Knobs are calibrated and easy to adjust. If needed, you can remove and replace the entire control merely by pulling a single jack plug — there are no other connections to break.

CHALMERS

A-4628

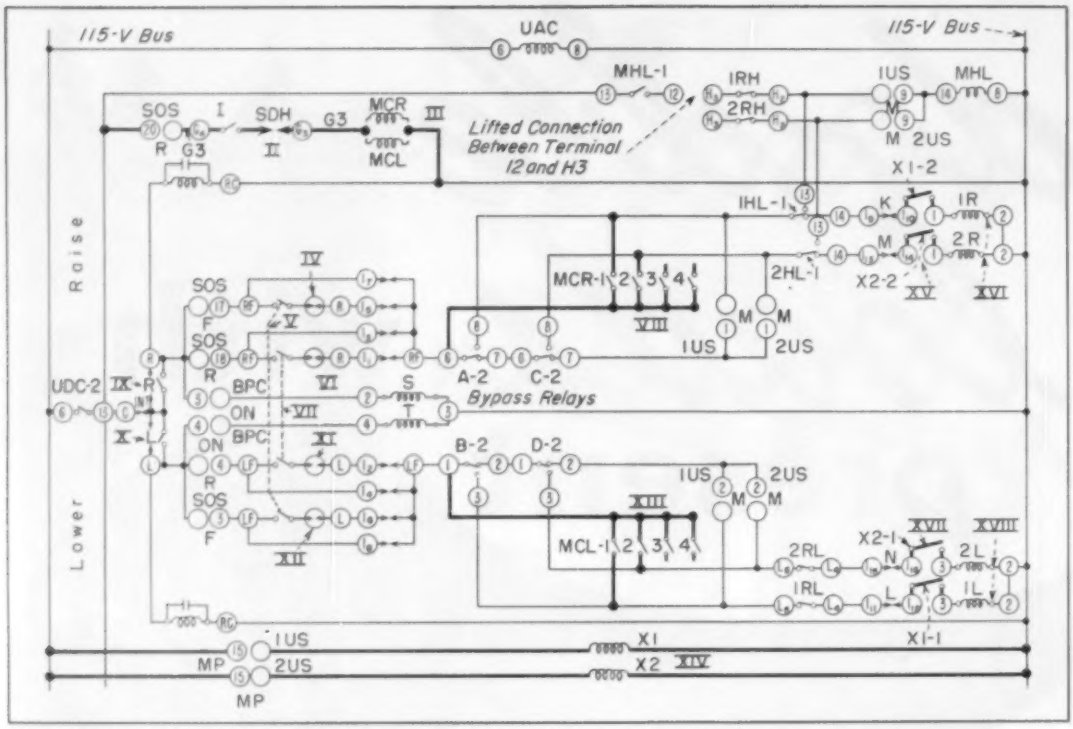


FIG 1—HEAVY LINES show changes to automatic generation control to obtain simultaneous control of all units

GENERATION—Design

Multiple-Unit Control Speeds Response to Load Changes

PAUL E. PFISTER, System Meter Engineer, Indiana & Michigan Electric Co, Fort Wayne, Ind.

Multiple-unit control has been added to automatic generation control at Twin Branch and Tanners Creek stations to increase response to large, rapid load fluctuations. With multiple control raise or lower impulses are routed to all generating units simultaneously when the schedule-deviation recorder reaches a pre-set limit, either low or high.

Between the pre-set limits generation control operates in the normal manner. That is, impulses go to one unit at a time and maintain loading proportional to each unit's capability. This type of control alone was not usually fast enough to follow large changes.

Both plants have proportional-loading control that will operate with either load or frequency deviation from schedule. Multiple control for load deviation was added to both plants, and multiple control for frequency deviation was added only at Twin Branch station.

Simple changes and additions were required to add the multiple control for load deviation to existing equipment, as indicated by heavy lines in Fig 1. Multiple-contact relays MCR and MCL having one contact for each generator were connected so that their operating coils are energized through cam-controlled contacts in the schedule-deviation recorder.

One DPST relay per unit, X1 and X2, was required to prevent operation of raise or lower lights and governor-motor contactors on units which might be off automatic control. Normally, the governor-motor contactors that raise generation are controlled by contacts of relays 1R and 2R, whereas those that lower generation are controlled by relays 1L and 2L.

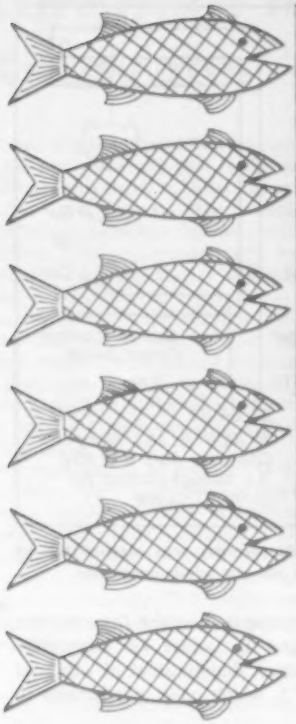
(*Continued on page* 124)

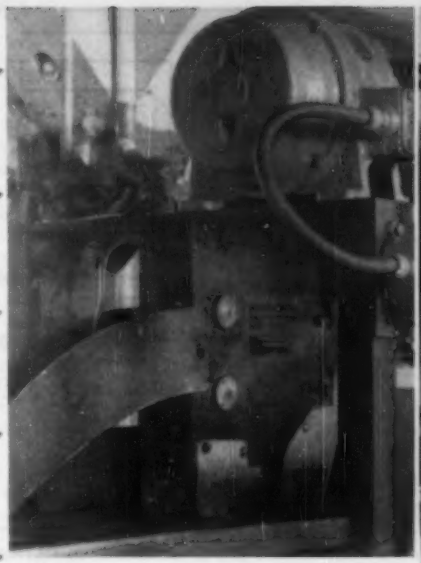
How Multiple Control Operates

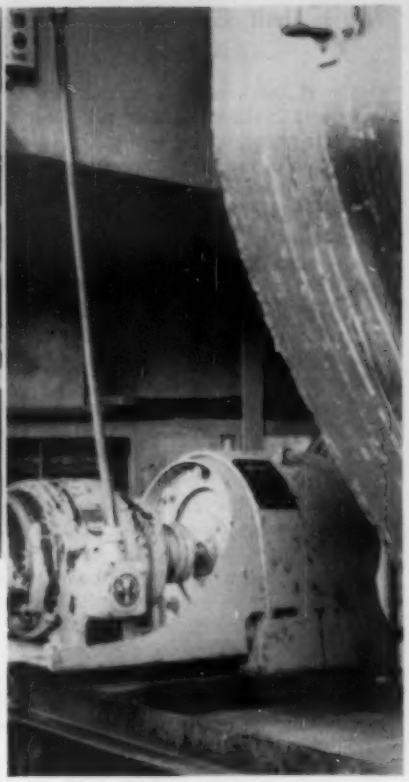
In Fig 1, master-controller contactors R and L (IX and X) originate and transmit raise and lower impulses to corresponding frequency anticipator (IV or XII) or generation anticipator (VI or XI). Impulses then go through corresponding contacts of MCR or MCL relay to energize relays 1R and 2R (XVI) or 1L and 2L (XVIII). The latter relays operate governor-motor contactors to raise or lower generation of all units.

However, this operation cannot occur until the MCR and MCL relays are energized by closure of the multiple-control cutout switch (I) and contact SDH (II) in the schedule-deviation recorder. The recorder contacts close when deviation reaches the pre-set limit, either high or low.

When a generator is taken off automatic control, its relay X1 or X2 (XIV) is de-energized to prevent operation of the raise and lower lights and governor-motor contactors of that unit.







Motors on automatic fish processing line at a Washington cannery, showing flexible leads of tough, water- and oil-resisting TIREX SO Cords that work in a shower of fish cleanings and steam.

TIREX CORDS solve problem of keeping motors running in fish cannery...

Automatic fish processing machines at a Washington cannery take fresh fish at one end of a long table, remove entrails, fins, tails, heads and scales, and deposit meat ready for canning at the other end.

The machines are driven by small motors that work in water and gurry, and that have to be hosed down with live steam.

Water kept getting into the motors and causing them to fail.

The cannery's chief electrician covered the motor cables with three different types of flexible conduits.

None of them kept the motors dry.

He solved his problem this way:

He used TIREX SO Cords with watertight fittings for the motor leads.

Now no water gets into the motors.

TIREX again proved its ability to stand up and "take it", even under constant attack from water, heat and oil.

Have you a problem TIREX might solve? If you have, write to the address below.

Simplex-TIREX SO Cords

SIMPLEX WIRE & CABLE CO.
79 Sidney Street, Cambridge 39, Massachusetts

Multi-Unit Generation Control

(*Continued from page* 122)

The H and L contacts and the sensitivity-changer cut-out switch in the schedule-deviation recorder were rewired, Fig 2, to permit cutting out multiple control when desired. The width of the normal operating band is easily adjusted by cams which operate the H and L contacts and should be determined by operating experience. Where two or more stations are on control in the same area, one station may require a different band width than another for the most efficient overall operation.

At Twin Branch, for multiple control from frequency deviation, contacts which energize the high and low-frequency indicating lights were used to also energize the MCL and MCR relays.

When Twin Branch is on load-deviation control, the frequency controller is cut out. When this plant is on flat-frequency control the contactors of the load-deviation recorder will not function, but the frequency-controller contacts will route raise or lower impulses to all machines when frequency changes indicate heavy load swings.

This feature will be added to the frequency control at Tanners Creek if operating experience indicates that the plant would be used on flat-frequency control.

Automatic generation control with the multiple-control feature has been operating successfully at Twin Branch since September, 1953, and at Tanners Creek since December, 1953. No difficulty has been experienced from simultaneously energizing the coils of the raising and lowering relays (MCR and MCL) because the impulse from master-controller contactors R and L cannot be transmitted simultaneously. This permitted simplification of cam and contact arrangements, Fig 2, which omits connections to contact L and terminal G2.

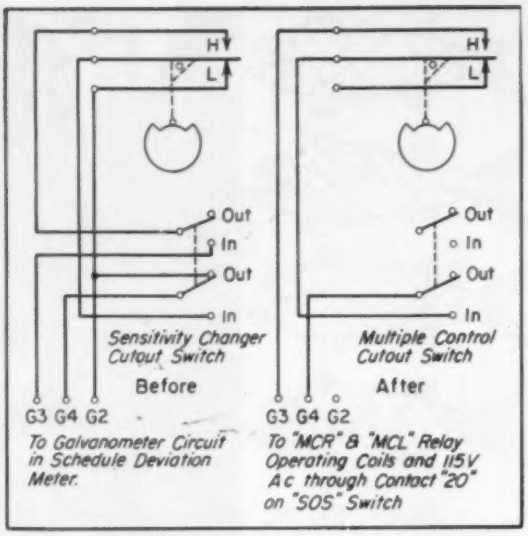
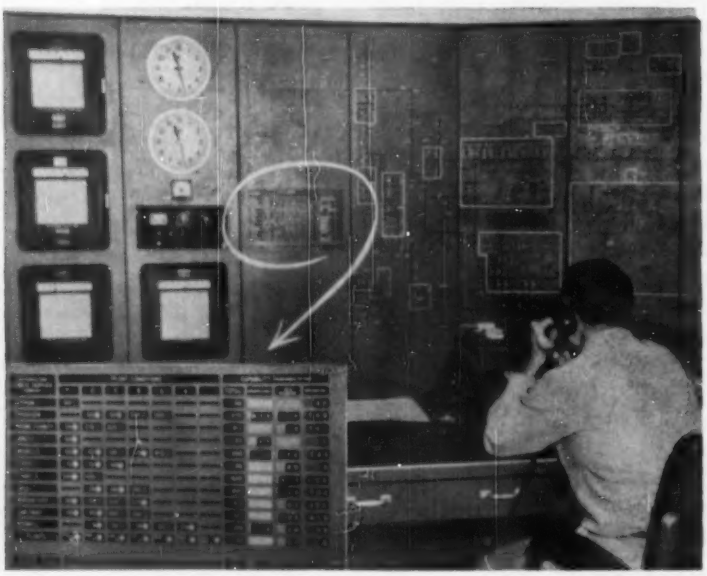


FIG 2—SCHEDULE DEVIATION recorder was reconnected so multiple-unit control can be cut out when necessary

SYSTEM ENGINEERING—Dispatching

Dispatcher's Chart Shows Plant and System Capability



SYSTEM DISPATCHER easily views capabilities of 35 units in 11 steam plants, plus internal-combustion units, by means of chart located on dispatcher's board

RALPH T. PRICE, Chief Operator, Southwestern Public Service Co, Amarillo, Texas

Condition of 35 turbogenerators in 11 steam plants and of seven internal-combustion plants may be seen almost at a glance on a system capability chart used by Southwestern Public Service Co. Location of the chart in the system dispatching center is an invaluable aid in scheduling generation during routine and emergency operations.

As illustrated, the chart lists capability ratings in hundreds of kilowatts for all plants and the system showing the following conditions: Installed, idle (standby), unavailable, and in operation. For each machine, the chart shows the total capability and number of the unit and whether it is in operation.

Lettered plastic tape strips are used for all permanent information, such as plant names, unit numbers and

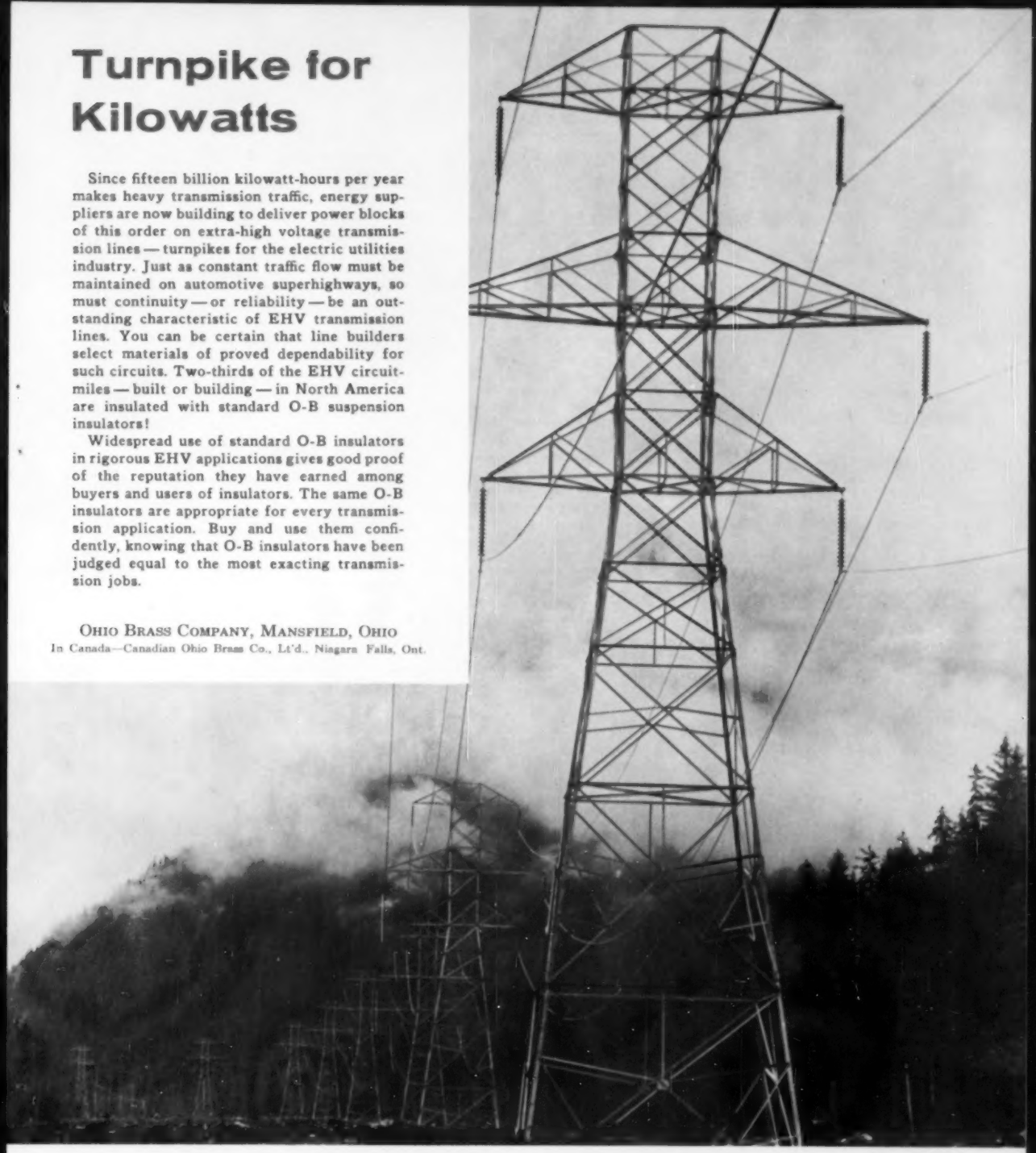
(*Continued on page* 129)

Turnpike for Kilowatts

Since fifteen billion kilowatt-hours per year makes heavy transmission traffic, energy suppliers are now building to deliver power blocks of this order on extra-high voltage transmission lines — turnpikes for the electric utilities industry. Just as constant traffic flow must be maintained on automotive superhighways, so must continuity — or reliability — be an outstanding characteristic of EHV transmission lines. You can be certain that line builders select materials of proved dependability for such circuits. Two-thirds of the EHV circuit-miles — built or building — in North America are insulated with standard O-B suspension insulators!

Widespread use of standard O-B insulators in rigorous EHV applications gives good proof of the reputation they have earned among buyers and users of insulators. The same O-B insulators are appropriate for every transmission application. Buy and use them confidently, knowing that O-B insulators have been judged equal to the most exacting transmission jobs.

OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Lt'd., Niagara Falls, Ont.

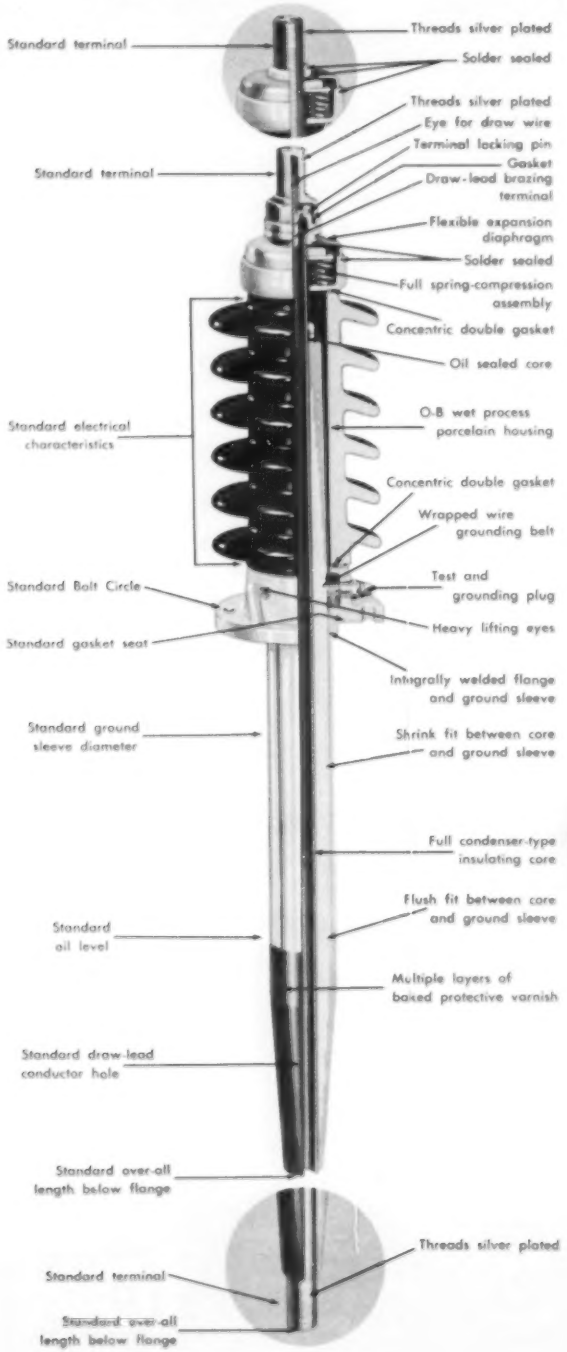


Ohio Brass

FEATURES OF
O-B'S NEW ASA STANDARD BUSHINGS

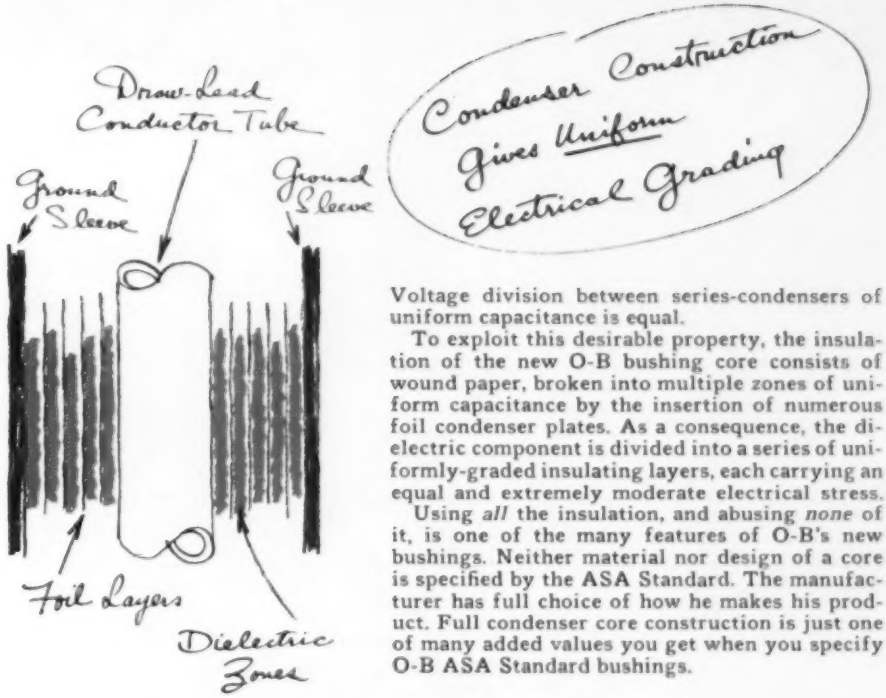
(Draw-lead transformer type in full view. Fixed conductor type in insets.)

ASA STANDARD REQUIREMENTS **O-B FEATURES**



FULL CONDENSER CORE CONSTRUCTION

Uses All the Insulation...Abuses None of It!



Voltage division between series-condensers of uniform capacitance is equal.

To exploit this desirable property, the insulation of the new O-B bushing core consists of wound paper, broken into multiple zones of uniform capacitance by the insertion of numerous foil condenser plates. As a consequence, the dielectric component is divided into a series of uniformly-graded insulating layers, each carrying an equal and extremely moderate electrical stress.

Using *all* the insulation, and abusing *none* of it, is one of the many features of O-B's new bushings. Neither material nor design of a core is specified by the ASA Standard. The manufacturer has full choice of how he makes his product. Full condenser core construction is just one of many added values you get when you specify O-B ASA Standard bushings.

TECHNICAL COMPETENCE the heart of every *Ohio Brass* bushing

If linemen were four-handed

With simplicity in mind, O-B designers shape distribution hardware as though it were to be installed most frequently in below-zero weather on dark and snowy nights. O-B hardware has big, easily-held nuts, bolts, and moving parts; few (frequently with no) loose parts; plenty of clearance for wrenches and gloved fingers.

If linemen were four-handed, it wouldn't be so important to keep hardware simple and easy to handle. Loose parts and lots of nuts and bolts would offer no problem. But we've never seen a quadrimanual Homo sapiens (four-handed feller), and we suspect that simple-to-handle hardware will always be important to linebuilders.

This *workable* O-B Distribution Hardware is always available at your local Graybar house; and while you may not be four-handed, you'll certainly be forehanded if you arrange now with Graybar to maintain a working supply in the Graybar storeroom for your use when you need it!

OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Lt'd., Niagara Falls, Ont.

4535H

Ohio Brass

Dispatcher's Chart

(*Continued from page* 124)

capabilities, and column headings. Square and round alnico magnets show information that changes, such as plant and system capabilities and condition of each unit. Square magnets are numbered from 1 through 0; round magnets are colored, with red for "in operation," yellow for "unavailable," and green for "idle." Tape strips for unit capabilities are permanently coded in these colors to show normal, or off-peak, operating conditions. The round magnets are placed over these colors as the generation schedule changes.

Square magnets also show limitations other than generator capability, such as BL for boiler limitation, and TL for transformer limitation.

TRANSMISSION—Maintenance

THE PILEATED WOODPECKER

Metal Ribbons Might Scare Pileated Pecker

As a result of D. A. Campbell, Jr.'s article on the alliance of four utilities against the pileated woodpecker (EW, June 20, p 24), information has been received at Electrical World which may be helpful:

The Audibon Society in New York City has suggested that the pileated woodpecker might be frightened away from a utility pole if spirolum whirlers are strung from the crossarm to some sort of a fixture attached near the base of the poles—perhaps another crossarm.

Spirolum whirlers are flashy, twisted strips of metal that twirl gaily in the breeze at filling stations and around used-car lots. They are manufactured by a New York concern.

(*Continued on page* 132)

"It ain't fair, Cyclone Fence ruins our work and our play"

Cyclone Fence protects everything from baby fish to nuclear reactors. It's a heavy-duty fence, built to rigid industrial standards—that's why it is the most widely used property protection fence in the whole wide world.

You *can* buy cheaper fence than Cyclone, but it will cost more in the long run. Cyclone contains nothing but brand-new, top-quality material.

The chain link fabric is woven from heavy steel wire — galvanized *after* weaving to prevent cracks that encourage rust. Erection is handled by full-time, well-trained experts, so you can be sure of a fence that stays taut and trim.

Cyclone engineers will be glad to help you solve your fencing problems. *Send for the free booklet.*

CYCLONE FENCE DEPT., AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION
WAUKEGAN, ILLINOIS · SALES OFFICES COAST-TO-COAST · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS CYCLONE FENCE

Cyclone is the trade-mark name of fence made only by Cyclone. Accept no substitute.

FREE BOOKLET ON FENCE

Our informative booklet is filled with photographs, drawings and graphic descriptions of different styles of fence and gates for the protection of property. Whether you're interested in a few feet of fence or miles of it, you'll find this booklet worth your while. Send for your copy. It's free.

CLIP THIS COUPON — SEND IT TO

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Please mail me, without charge or obligation, a copy of your booklet.

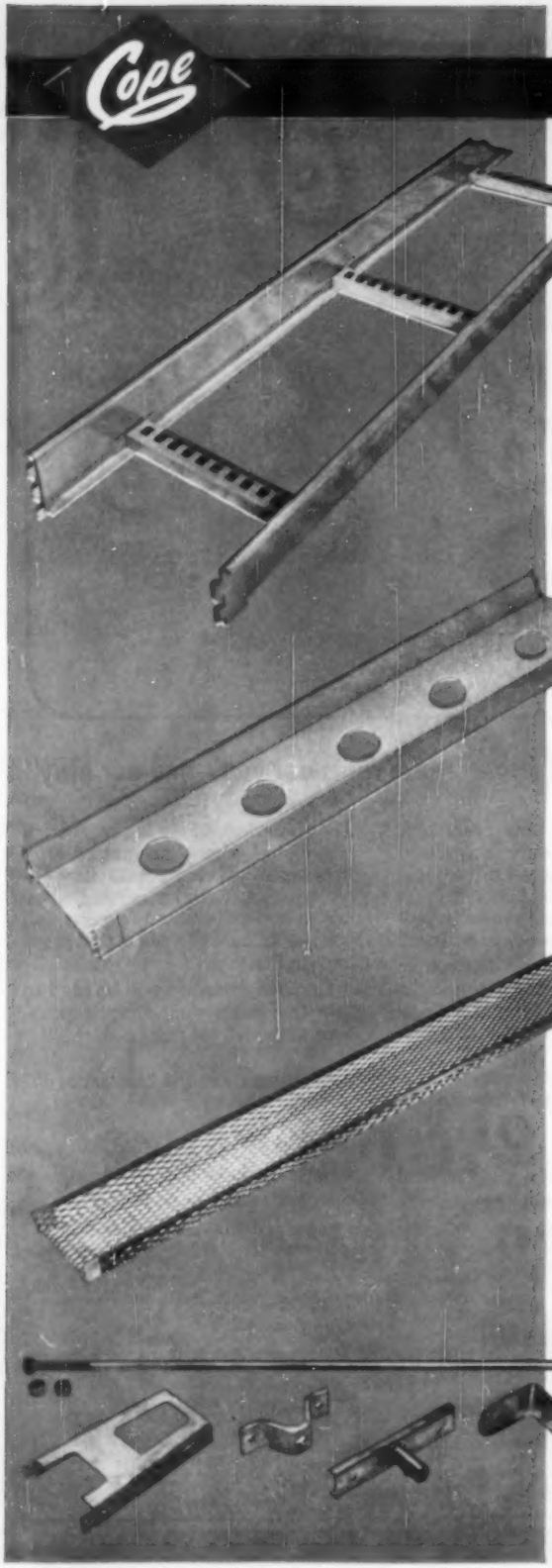
Name.....

Address.....

City.....Zone....State.....

USS

UNITED STATES STEEL



CABLE LADDER

This new Cope product has been developed specifically for the support of interlock armor and other semi-rigid cables which require only intermittent support. Basically, the Cope Galvanized Steel Ladder consists of two main "Z" shaped stringers to which rungs are welded on 18" centers. The rungs are suitably slotted to permit cables to be quickly clamped to them with simple band type cable straps and pads. Cope Cable Ladder is supplied in widths of 6", 9", 12", 16", 18", 20" and 24" and in 12 foot lengths. Ladder sections have been designed to connect with Cable Trough of similar width. Horizontal and vertical fittings for all widths are standard items.

CABLE CHANNEL

The Cope Cable channel has been designed to supplement ladder and trough by providing an economical means of supporting a limited number of armored or non-metallic jacketed cables — such as would occur in branch runs, etc.

Cope channel is available in 12 foot lengths in widths of 3" and 4". All sections except vertical risers are provided with ventilation and drainage holes. Horizontal and vertical fittings are also available.

CABLE TROUGH

The popular expanded metal Cable Trough is ideal for supporting runs of non-metallic jacketed cables where continuous support is required. The trough is supplied in widths of 6", 9", 12", 18" and 24" and lengths of 8, 10 and 12 feet. Standard fittings for each width permit the trough to make changes in direction and elevation, join and cross, and, in short, conform to any plant layout.

MOUNTING HANGERS

T. J. Cope, Inc. also supplies a complete line of quick connecting mounting brackets designed for maximum strength, durability, and versatility to support the Trough, Ladder and Channel. These supports can be hung from almost any structural member such as vertical or horizontal beams, cinderblock and cement walls and ceilings, and from existing conduit systems etc. All parts are hot dipped galvanized after fabrication.

WITH THE EXCLUSIVE COPE PIN-TYPE COUPLER CUTS ASSEMBLY TIME 80%

T. J. Cope, for many years the leader in the design and manufacture of expanded metal Cable Trough systems, now offers to the electrical industry a *complete* standardized system of supports for *all types* of electrical cable.

This has been made possible by the addition of Cable Ladder and Cable Channel to the already popular line of Cope Cable Trough.

All units in the Cope system are equipped with the new pin-type couplers which permit sections to be joined together in a matter of seconds to form a strong mechanical joint without the use of nuts, bolts and washers.

Find out more about this complete supporting system. Write today for further information — ask for Bulletin W-7.

Cope

T. J. COPE, INC.

711 SOUTH 50th ST., PHILADELPHIA 43, PA.

NO. 8 IN A SERIES ON ASSURED POWER CONTINUITY

...Why you should insist on Double-Source Control and Full Phase Protection in your Automatic Transfer Switch

Fundamental to the effective operation of an automatic transfer switch is the principle that the operating power for the switch must be obtained from the monitored source to which the load is being transferred. The reason for this is clear: the transfer might be made to an inadequate source or transfer may be impossible despite the availability of the preferred or normal source of supply.

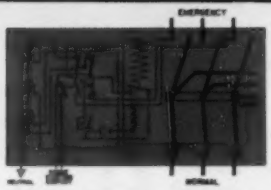
ASCO Automatic Transfer Switches operate on this *double-source control* principle. And, additional protection is built into ASCO equipment through the use of a monitoring lockout relay to assure load transfer only when the new source reaches the proper voltage and frequency. Until this condition is reached the switch is mechanically held to the original source utilizing whatever power is still available.

For vital *full-phase protection*, ASCO industrial type voltage relays constantly monitor all phases of the normal source so that a drop in voltage or failure of one leg on three-wire, or phase failure on four-wire automatically initiates transfer. Full phase relays will start transfer when voltage at the normal source drops to 70% or less. Restoration to normal cannot be made until all phases are 90% or more. For critical loads full phase relays are furnished with adjustable drop-outs set as high as 90% with pick-up at 95%.

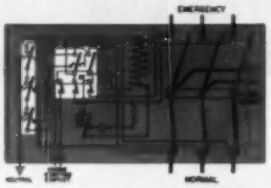
To see why only ASCO-designed Automatic Transfer Switches provide all these essential provisions against power outage, study the accompanying wiring diagrams which briefly explain the switching operation and its built-in protective design.

COMPARE . . .

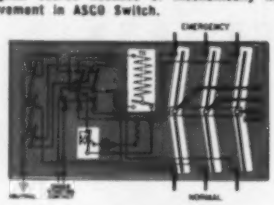
then insist on ASCO Automatic Transfer Switches. No other switch can give you such sure and complete protection.



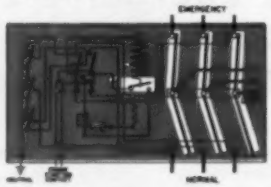
1. Normal functioning of ASCO Automatic Transfer Switch. **Full phase protection is provided by Voltage Relays 1V, 2V and 3V.**



2. Normal source voltage drops below 70%. Voltage Relays open, de-energizing Source Selector Relay SE. Lockout Relay LO is still open, waiting for emergency source to attain proper voltage and frequency. **Load is still connected to original source because of mechanically held movement in ASCO Switch.**



3. Emergency source now adequate. LO closes, permitting coil TS to be momentarily energized, causing transfer to proceed. **Note double-source control: operating power for transfer is obtained from the source to which the load is to be transferred. Transfer occurs instantaneously!**



4. Transfer has taken place. Emergency power is feeding the load. **Switch remains on emergency source until Full Phase Relays perceive restoration of normal source to 90% or better.** At that time Relays effect closing of top contacts of SE and return to normal source occurs.

THIS INFORMATION SHOULD BE IN YOUR FILES...

For complete data write for Publication 502 and the other advertisements in this series. They explain in detail the efficient functioning of ASCO Switches.

Scare Woodpecker

(*Continued from page* 129)

John K. Terres, managing editor of Audibon Magazine, recalled that a West Virginia University experimental station had unprecedented success with these flashers. They scared away from blueberry patches all birds that had defied previous measures with unconcerned abandon.

Meanwhile, a bird expert at the American Museum of Natural History said woodpeckers hack away for three reasons:

- They are making a nest. Because of its enormous size (about a foot and a half long), the pileated bird has wrecked many a pole by trying to peck out a nest big enough to accommodate its large body.
- They are courting. In this case, the males merely want to make noise. They tattoo on anything handy, including metal gutters. The noise attracts the females, and simultaneously serves notice to males within earshot that "this is my territory. Stay out."
- They are seeking food. Woodpeckers seem to have an "uncanny" way of knowing when carpenter ants or termites are in trees that appear to be in good health. They peck a hole big enough to get their beaks into, then shoot out their long tongues after the grub.

This big bird is credited with rescuing millions of acres of spruce timber from Engelmann's spruce beetle. These varmints were destroying spruce trees at an alarming rate several years ago. Pileated woodpeckers swarmed into the Colorado-Utah area in flocks. Their tongues, barbed on both sides, could slither up eaten-out passageways in the trees and spear the beetles. Eventually the woodpeckers brought this pest under control.

The pileated pecker is still a relatively untamed bird that inhabits the depths of old forests and seeks the seclusion of wild, wooded country. But Terres said the species seems to be adapting itself to civilization. A few now reside only five miles from the heart of New York City. A pair of them now patronize a bird feeding station "operated" in Thomasville, Ga., by Herbert L. Stoddard, an expert on the bob-white quail.

They are moving East again as trees grow old on farmland, which was deserted long ago because of its poor yield.

(*More How To on page* 136)

1 ... NATURALLY ...
the best insulation is
MICA
Nature's never-failing
indispensable dielectric.
2 ... and NATURALLY...
this insulating power, and resistance to heat, cold, moisture, oil and friction, must be perfected for efficient, economical use, uniformity and precision . . .
3 ... so NATURALLY...
the world looks to
MACALLEN MICA
. . . which develops and guarantees these PLUS qualities for superior, dependable uses of Mica in electrical and industrial insulation.

THE MACALLEN COMPANY

BAY ROAD, NEWMARKET, NEW HAMPSHIRE

when you think of MICA ... think of MACALLEN

MACALLEN MICA

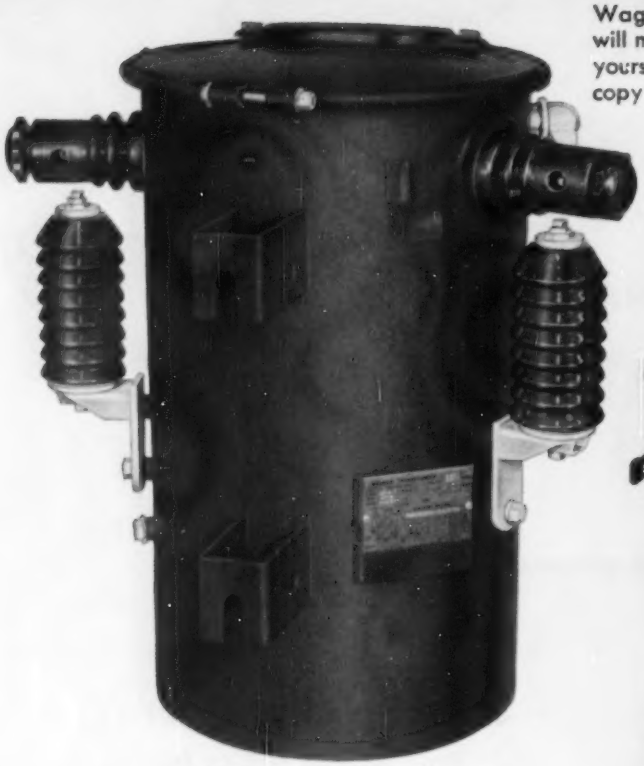
ALL FORMS • ALL QUANTITIES • ALL DEPENDABLE

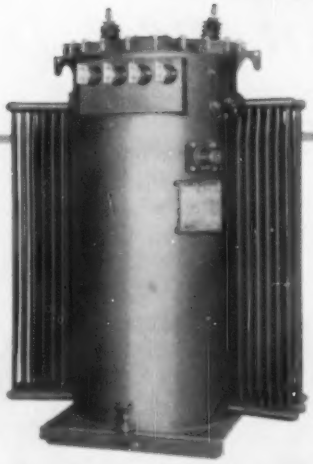
CHICAGO: 565 W. WASHINGTON BOULEVARD • CLEVELAND: 1231 SUPERIOR AVENUE

Wagner®
TRANSFORMERS
...the choice of leaders in industry

Here's why it pays to

Wagner Form W Distribution Transformers will meet *your* requirements. Full details are yours in Bulletin TU-180. Write for your copy today.





Form W Construction available in ratings up to 500 Kva

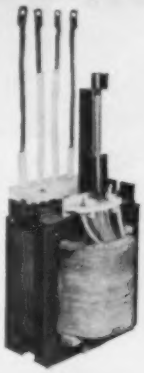
You can get Wagner Form W Transformers in a complete range of ratings, from 3 to 500 Kva, with protective features to meet your needs.

Wagner Electric Corporation
EST. 1891

choose Wagner Form W Transformers...

FORM W ELEMENT

Wagner Form W Transformers pay dividends in longer service life. The Form W element, with preformed cores of cold rolled, oriented grain steel, permits a liberal design in small size, lightweight transformers that give excellent electrical performance. And, whenever you buy a Wagner pole type Distribution Transformer, you get a transformer with many important *extra* features.



NEW HIGH VOLTAGE SIDEWALL BUSHING

This bushing, for use with either copper or aluminum conductor, permits FASTER connections —conductor is simply pushed into the connector and held tightly with a few turns of the knob ... EASIER connections—no tools are needed ... SAFER connections—insulated knob protects lineman when tightening the terminal.

NEW LOCKED LOW VOLTAGE BUSHING

This secondary bushing is *key-locked* to prevent rotation. The terminal is locked to the porcelain, too, so it is impossible for the assembly to slip or turn when the terminal is being tightened or loosened. No more loose inner terminal connections to cause internal shorts.

SHUR-SEAL COVER

Wagner pole type transformers are sealed air-tight. The Shur-Seal cover is fitted with a clamping ring that firmly seals the cover to the tank. No atmospheric moisture or dust particles can get inside. Although this construction is as air tight as a welded tank, the cover may be removed by just loosening a single, stainless steel bolt.

INHIBITED OIL

You get extra years of service from Wagner distribution transformers because the Wagner 7NI oil used in these transformers reduces oxidation to a minimum and retards the formation of acids and sludge.

T55-13

AND...THEY'RE SHIPPED IN DRUMS!

Wagner Type HEF and HEK Transformers from 3 to 10 Kva are now packed in sturdy fiber drums for ease of shipping, handling and storage. Each drum is sealed, so that when you open it, the transformer is free from dust and grease—as clean as it was the day it left the Wagner plant.

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave. • St. Louis 14, Mo., U.S.A.

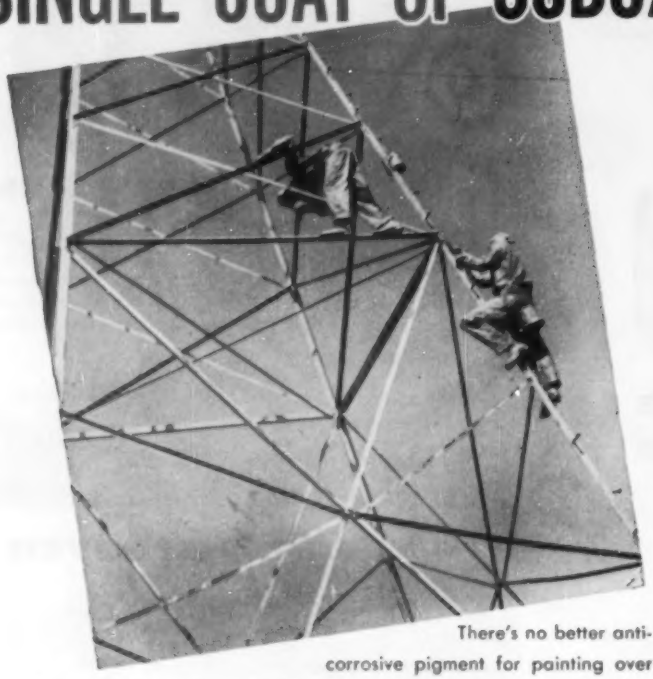
ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

Expect 5 to 8 YEARS protection

for galvanized towers from a

SINGLE COAT OF SUBOX



There's no better anti-corrosive pigment for painting over galvanizing than active suboxide of lead—the basic pigment in Subox and Subalox paints.

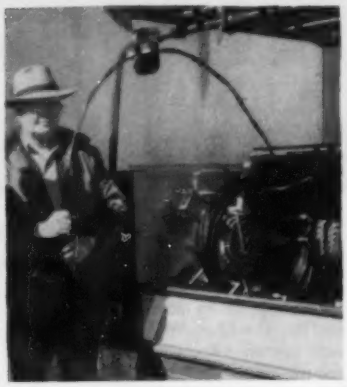
There's no surer way to get economical and effective preservation of galvanized structures than by coating them with Subox or Subalox. In most instances, a single coat is sufficient and Subox or Subalox—will not chip, crack or blister during years of exposure to the elements.

What's more, repainting is simpler and more economical when these paints are used. They cost no more than any good paints, and can be relied on to save you money for years.

Write For A Free Copy of "Corrosion Control of Electrical Structures and Equipment"

Subox Inc.

3 FAIRMOUNT PLANT
HACKENSACK, N. J.



Reel Pays-Out Line Safely and Quickly

W. B. WEST, Public Service Co of Colorado, Monte Vista, Colo.

A pay-out reel designed by Public Service Co of Colorado permits one man to safely string a service drop with controlled speed and tension in less time. Used with a pulley guide, the reel keeps wire tangle-free, reduces scrap, and improves customer service.

The reel consists of an automobile front-wheel hub having good bearings and brake drum. Welded to the drum are five 3-in. channel-iron spokes. A metal box fitted around each spoke can be moved to any desired position by turning a threaded rod attached to both the box and spoke.

An arm of pipe and a threaded L-shape rod is welded to each box to accommodate varying coil widths. Diameter of the arms can be varied between 16 and 28 in. The largest coil used on the reel has been a 1,900-ft coil of No. 8 WP wire, weighing about 213 lb.

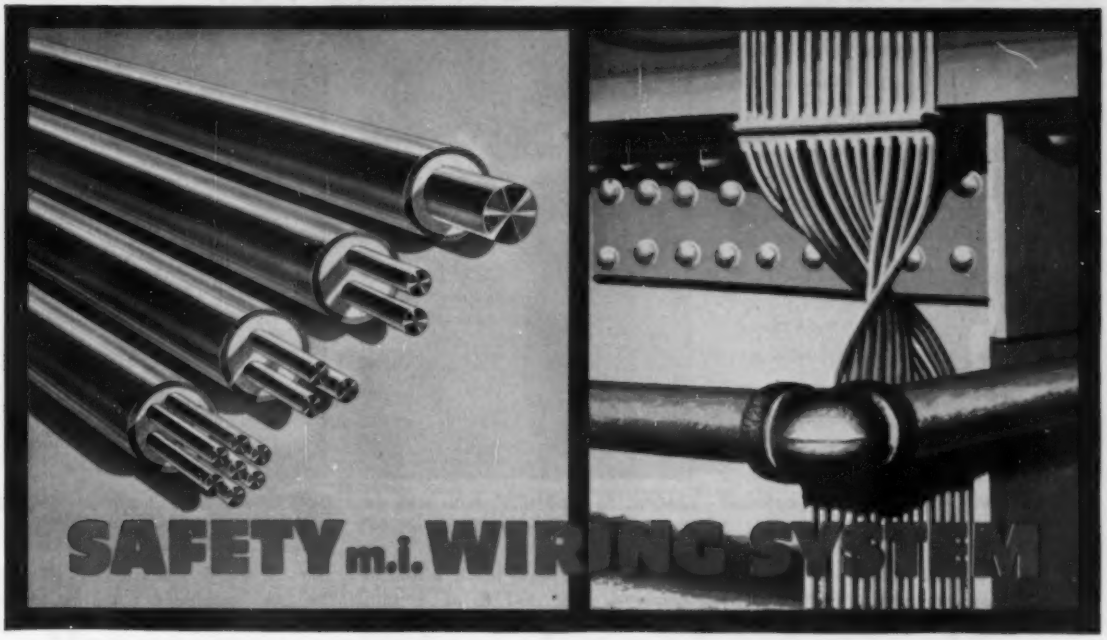
The wheel hub is welded to a channel iron with a cross-piece at each end. To mount the reel the cross-piece is bolted to the side of the truck or laid horizontally. The reel can be made to fit any size truck and costs about $75 with a mechanical brake for controlling tension.

The guide, made by mounting four pulleys on a bracket, is fastened to either the ladder rack or truck bed. With the guide, wire can be pulled from the reel at any angle without tangling.

The author plans to patent the reel and have it manufactured commercially.

GENERAL CABLE

THE GREATEST NAME IN ELECTRICAL WIRE AND CABLE



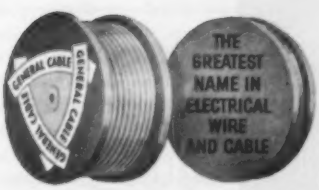
A dramatic new advance in electrical wiring for all applications up to 600 volts and wherever heat, vapors, moisture and aging are problems. Safety m.i. Wiring is ideal for low voltage, lighting, power, control, machine tool and equipment uses.

The mineral insulation of Safety m.i. Wiring is physically stable up to 2800° Centigrade . . . will not burn, deteriorate, support combustion, or convey flame . . . provides extra safety in boiler rooms, around steam pipes, boiler stacks and other "hot spots." Simple fittings seal both ends of wiring runs . . . no possible entrance for moisture.

Underwriters' Approved Safety (Type m.i.) Wiring Systems offers lower installation and maintenance costs. Acts as its own conduit . . . can be installed in one operation with standard switch and junction boxes. Easily shaped on the job, Safety m.i. can be fastened with standard clamps or straps . . . stays put permanently!

Save time and money! Get a neater job! Simplify planning! Ask your General Cable Representative for all the facts about Safety m.i. Wiring Systems. Remember, too, General Cable is the *only* manufacturer who can supply *all* your wire and cable needs!

GENERAL CABLE
CORPORATION



BARE, WEATHERPROOF, INSULATED WIRES and CABLES FOR EVERY ELECTRICAL PURPOSE

GENERAL CABLE CORPORATION
Executive Offices: 420 Lexington Ave., New York 17, N. Y.

SALES OFFICES: Atlanta • Baltimore • Boston • Buffalo Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit Erie (Pa.) • Greensboro (N. C.) • Houston • Indianapolis Kansas City • Lincoln (Neb.) • Los Angeles • Memphis Milwaukee • Minneapolis • New Haven • Newark (N. J.) New York • Philadelphia • Pittsburgh • Portland (Ore.) Richmond (Va.) • Rochester (N. Y.) • Rome (N. Y.) St. Louis • San Francisco • Seattle • Springfield (Ill.) Syracuse • Tampa • Tulsa • Washington, D. C.

Induction Heat for Brazing . . .

- **Speeds autoclave output 400% with same labor**
- **Keeps working area clean and comfortable**

E. D. ANDERSON, Elmer D. Anderson Co, 60-Cycle Design, Dearborn, Mich.

Assembly and silver-brazing of sterilizing autoclaves was boosted 400% when Pelton & Crane Co, Detroit, installed a 60-cycle induction heating unit to speed production.

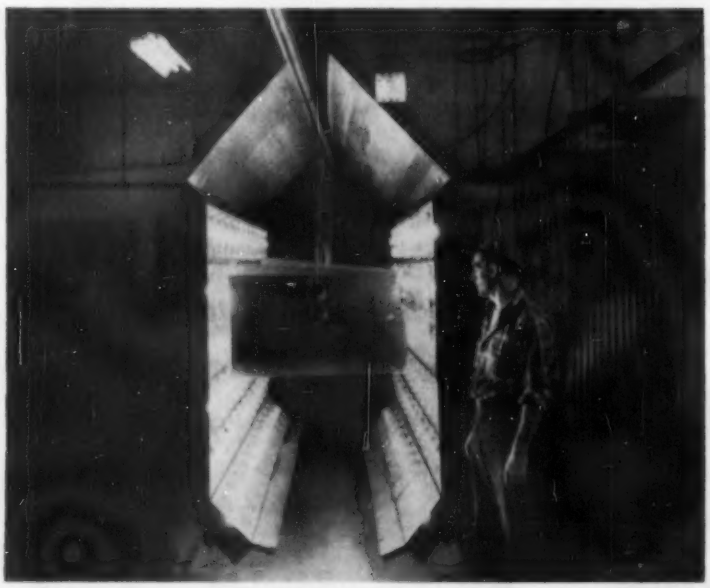
Inner and outer tanks of the autoclaves are silver-brazed to forged door flanges. This was a production bottleneck while the former gas-fired heater was used. Now the operator assembles and brazes four units in the time it formerly took him to do one unit. Furthermore, cooler working conditions and a cleaner brazed part resulted from the induction unit.

Tanks are put on the induction unit, brought up to heat, brazed, cooled, then removed. Parts reach a brazing temperature of 1125F in 6 min, under the influence of the induction coil which has a 9-in. OD, and a 5½-in. ID. The coil is situated under the asbestos board, which covers part of the transite table top, and is about an inch from the point of brazing. The 10-kva unit works directly from line voltage.

LAMINATED MAGNETIC cores stick out of transite cover over induction coil

OUTER SHELL of autoclave is slipped over inner, which rests on door flange

Infrared Drying Tunnel Ups Plane Production, Cuts Labor



VERSATILITY IS THE KEYWORD of this 30-kw infrared tunnel used by Piper Aircraft Corp to dry painted airplane assemblies of various sizes and shapes

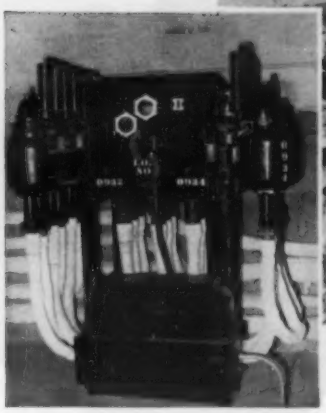
- **Old ovens 'jettisoned'**
- **Profits now 'fly higher'**

KENNETH H. BREON, Industrial Representative, Pennsylvania Power & Light Co, Williamsport, Pa.

An infrared drying tunnel installed at Piper Aircraft Corp's Lock Haven, Pa., plant has resulted in increased production, improved quality of painted finishes, reduced labor, more comfortable working conditions, lower maintenance costs, and increased profits.

Used for drying paint on aircraft parts, the device is designed to accomodate different sizes and shapes of plane assemblies. Several tunnels of this type are used in different sections of the plant. The connected load of the one shown is 30kw. Infrared tunnels have replaced completely the oil and gas-fired units previously used for drying paint.

(*More Industrials on page* 142)



Switch vault at fabulous Fontainebleau Hotel where durable neoprene-jacketed PILC cables with asbestos fireproofing enter from FP&L conduits. Two sets of 15 kv cables are shown (left). Over 40 miles of neoprene-jacketed cable service Miami Beach.

Florida Power & Light Company reports:

Neoprene jackets solve corrosion problem of lead-sheathed cable at Miami Beach

CORROSIVE ACID GROUND WATER, formed by decaying underground swamps, was the problem faced by FP&L engineers at Miami Beach. A water table only four feet below street level was a further complication. Clearly a rugged, acid-resistant cable was needed for power distribution—and neoprene supplied the answer.

Extensive tests showed that neoprene jackets give lead-sheathed cable long-term protection against corrosion and galvanic attack. And neoprene's resilience and resistance to abrasion convinced FP&L they'd get long service despite vibration and cable movement. Today, *over 40 miles* of lead-sheathed cable jacketed with neoprene carry primary power to Miami Beach!

WHEREVER IT'S INSTALLED—above ground, in ducts or conduits, or buried direct in earth—neoprene-jacketed wire and cable give long, dependable service. Your supplier will give you more information. Neoprene-jacketed cable is available in single- and multiple-conductor types and in voltage ratings to meet your requirements.

NEOPRENE

The rubber made by Du Pont since 1932

DU PONT

Reg. U.S. Pat. Off.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

MAIL THIS COUPON TODAY!

FREE! THE NEOPRENE NOTEBOOK. Read how neoprene's resistance to *all sources* of deterioration cuts maintenance costs on products old and new. Actual on-the-job reports are featured in every issue. Clip coupon to get on the mailing list.

E. I. du Pont de Nemours & Co. (Inc.),
Elastomers Division EW-7, Wilmington, Del.

Please put my name on the mailing list for the Neoprene Booklet.

*Name*_____ *Position*_____

*Firm*_____

*Address*_____

*City*_____ *State*_____

PINCO... FIRST MODERN

IN THE FIELD TO INTRODUCE INSULATOR PACKAGING!

pinco packaging provides greater all-around utility

4 WAYS!

1 **Quick, Easy Identification of Contents**

COLOR CODE identifies each insulator *type* . . . RED for Suspensions . . . BLUE for Low Voltage Pin-Types . . . GREEN for High-Voltage Pin Types . . . RED and BLACK for Switch and Bus Units . . . BLACK for all other types.

STYLE NUMBER AND QUANTITY—Every Pinco container is plainly marked with number of insulators in package; also style number.

INSULATOR OUTLINE immediately identifies contents as Pin Type, Suspension, Guy Strain or Switch Type.

2 **Maximum Protection for Contents in Transit and in Storage**

Distribution Pin Types, Guy Strains and 6" and 7½" Suspension Units are packed in corrugated cartons—each unit separated and held firmly in place by heavy corrugated partitions. Pinco 10" Units are packed in hexagonal TENSION CRATES while Switch and Bus Units are packed solidly bolted in hexagonal and rectangular type crates.

3 **Easy Warehouse Handling**—Corrugated cartons are designed for ease in unit or pallet handling. Crates for larger units are also designed for safe, easy stacking in minimum space.

4 **Easy Handling of Contents**—All Pinco containers are designed to permit quick, easy access to contents.

You pay no more for Pinco quality porcelain and Pinco modern packaging . . . so why settle for less? Our thirty-five years of experience in designing and producing wet plastic process porcelain are yours to command. May we help you?

PINCO INSULATORS

1920 35 1955 YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

The Porcelain Insulator Corporation

LIMA, NEW YORK

Suspension Insulators . . .

Clamps and Fittings . . . Switch and Bus Insulators . . .

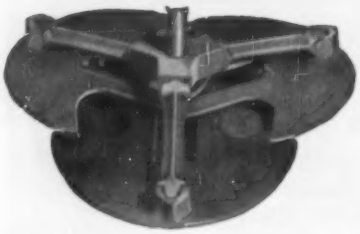
Distribution and High Voltage Pin Types . . .

Guy and Tree Insulation . . . Special Porcelain.

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life



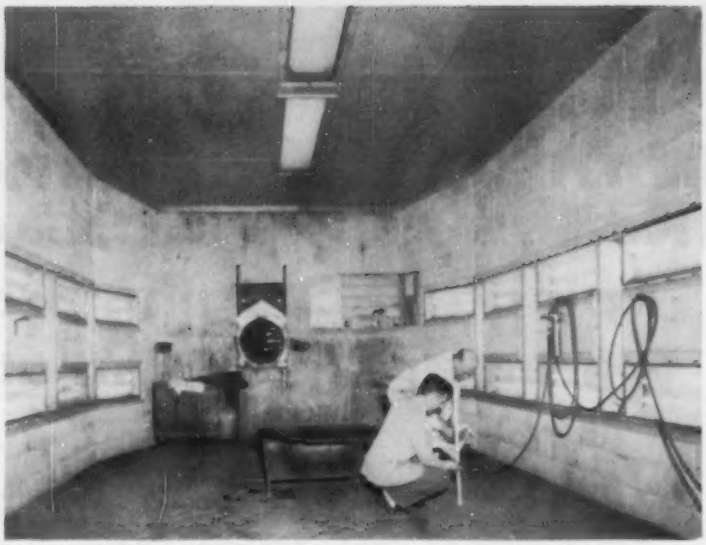
● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO

Manufacturer of "THE ANCHOR OF MERIT"

FAIRFIELD, IOWA



HIGH INTENSITY is provided by 3.7-kw mixture of fluorescent and slimline lamps recessed in walls and ceiling. Glass panels over fixtures keep paint off lamps

Cross-Lighting Cuts Shadows in Garage

J. H. DIVEN, Commercial Industrial Engineer, Idaho Power Co, Payette, Idaho

Cross lighting in the car-painting room of Paul A. Roberts Garage, Ontario, Ore., provides high intensity light with no shadows or dark areas. An effective combination of 4-ft and 8-ft fluorescent lamps produces an even level of illumination on the side of a car.

The short length and flexibility of 40-w T12 lamps prompted their use entirely on the walls. On the ceiling 96-in. T12 slimline lamps were installed.

Fixtures are recessed into the walls behind glass panels held by wing-screws, to minimize maintenance. These panels prevent the fine paint spray from settling on the lamps and reflectors and causing a difficult cleaning problem. Lamps are easily replaced in the highly accessible fixtures.

Intensities of horizontal light components, measured at a point approximating the side of a car, are 100 ft-c 1 ft from the floor and 110 ft-c 2 ft from the floor. Total wattage is 3 kw with about 705 w in ballast, giving a total connected load of 3.705 kw.

Storage Yard Illuminated by Mobile Light Tower

Built on a 4x4 pallet, this 12-ft tower of lights gets 30 ft of extra height when broad illumination is needed in the 300,000-sq ft materials-storage yard of Connecticut Terminal Co, Inc, New London. Powered by a 180-cps, 110-v dc generator (on pallet) capable of a 2,000-w output, the tower holds two type 2F luminaires with 250-w, G-30 bulbs (center) and a type 5F luminaire with a 500-w G-40 bulb on each end. Lights pivot through 36 deg. and are tiltable. Extension cords enable lights to be removed and spotted wherever needed.

EFCON Polystyrene Capacitors are mass produced in a range of standard capacitance values from .001 to 2 Mfd. Special values are made to customers' specifications.

EFCON

POLYSTYRENE
CLOSE TOLERANCE
MINIATURE CAPACITORS
are constructed with
NATVAR Styroflex® FILM

EFCON Polystyrene Capacitors manufactured by Electronic Fabricators, Inc., New York, have become standard for the electronic industry. They were developed for uses where high insulation resistance, low power factor and low leakage are necessary. These miniature capacitors are used extensively for filters, timing circuits, computers, and similar applications where close tolerances are essential.

Temperature and humidity are closely controlled in the winding department, and air is filtered to protect against dirt, dust, or other contamination.

Each unit, from start to finish, is checked at least 5 times for voltage and capacitance before being shipped. In this step, capacitors are tested at DC voltages at least 200% of rated voltage at 25°C.

These polystyrene capacitors are made to tolerances closer than ± 1%. Their development was made possible by the application of Natvar Styroflex® dielectric due to its flexibility, toughness, and uniformity.

In fact a distinguishing characteristic of all Natvar flexible insulations is that they are always uniform and always the same no matter where purchased.

Natvar

Natvar Products

- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
- Varnished—Silicone coated Fiberglas
- Varnished papers—tape and kraft
- Slot cell combinations, Aberglas®
- Vinyl coated—varnished—lacquered tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

Ask for Catalog No. 23

NATVAR CORPORATION

FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

TELEPHONE RAHWAY 7-8800 — CABLE ADDRESS NATVAR: RAHWAY, N. J.

221 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY

YORK-HOOVER'S

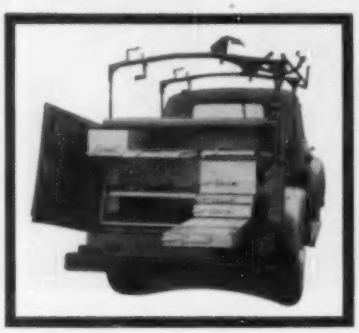
Model 201U76 "Proven" Service Body

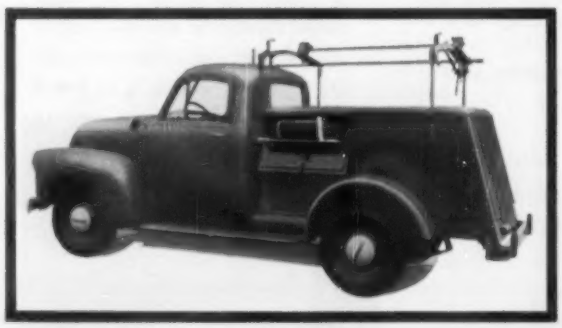
DESIGNED JUST FOR YOU

Right side view showing convenient material and tool compartments.

Why be satisfied with less when literally thousands of Model 201-U76 Service Bodies are providing fast and economical service in the Public Utility industry daily.

Designed to meet your particular needs—to carry all necessary materials and tools accessibly—to provide many years of dollar-saving, everyday service. Why not have Model 201U76 working for you?





Latest type ladder bracket, adjustable partitioned drawers.

Left side view showing readily accessible extra tire compartment.

YORK-HOOVER MODEL 201U76 SERVICE BODIES ARE EASY TO OBTAIN REGARDLESS OF YOUR LOCATION

GET THE FACTS! Write for Bulletin 930 today.

YORK-HOOVER
PUBLIC UTILITY BODIES

YORK-HOOVER CORPORATION
BODY DIVISION
YORK, PENNSYLVANIA

INDUSTRIAL BRIEFS

Converting dc distribution to ac in Cleveland's 30-yr-old Hanna Building was completed in June at a contracted cost of 60 cents per sq ft. Power now feeds into one all-enclosed bus duct station and is distributed to three switch centers having single- and three-phase service. Bus ducts, rated at 4,000 amp, can transmit almost triple the power of the old dc system. Conversion consumed almost 50,000 ft of cable. Now happy tenants are adding fluorescent fixtures to jump office illumination from 15 to 60 units. About 650 tons of air conditioning also will be put in. Bill Koster, Advertising Writer, Cleveland Electric Illuminating Co.

Heating a fuel oil pipe by passing electricity directly through the metal now raises the temperature of heavy No. 6 fuel oil from the temperature of the outdoor tank to 120F for Sylvania Electric Products' flashlamp plant in Montoursville, Pa. A 6-kva low-voltage transformer using the pipe's own resistance in the secondary circuit causes the heating, which enables the thick oil to flow smoothly toward the burner. As oil enters the furnace, a 1.38-kw immersion heater boosts its temperature to 170F. Oil also is circulated back to the outside tank to keep the fuel there at a satisfactory temperature. One 3-kw immersion heater in the return line raises the temperature of this oil to 145F. This installation has saved the company the expense of putting in extra piping and insulation, had steam heat been used. Furthermore, the scheme had a low installation cost, requires little maintenance, and is safe and adaptable to automatic control. This Thermal Electric Fluid Systems, Inc, equipment is covered by patent No. 2,224,403. Harry Moore, Industrial Representative, Pennsylvania Power & Light Co, Williamsport, Pa.

Baking enamel on milk coolers is now done in a 50-kw electric oven at Zero Manufacturing Co, Washington, Mo. The oven is designed to operate at temperatures up to 400F and to cure paint on four coolers an hour. This electric oven has done a more efficient baking job than competitive fuel and at lower cost to the user. Robert E. Enkelmann, Industrial Engineer, Union Electric Co of Missouri, St. Louis.

NEW...

Meet the
"Maintenance-Miser"
line of Westinghouse
Voltage Regulators

YOU CAN BE **SURE**... IF IT'S
Westinghouse

Ray Custard, Voltage Regulator Engineering, shows you some of the outstanding features of the new URL-16 pole-type regulator.

Position indicator can be reset from the ground with a hookstick. Direct mechanical drive assures positive operation.

Plug-in connector. All control leads to the tap changer, current transformer, and potential source terminate in this receptacle-type connector for ease in relocating control cabinet.

Unit assembly of tap changer and core-coil assembly provides greater strength and rigidity—no untanking required for inspection of contacts.

New Westinghouse URL-16 pole-type step regulator

Simplest, most economical step-type regulator ever built . . . to install, operate, and maintain

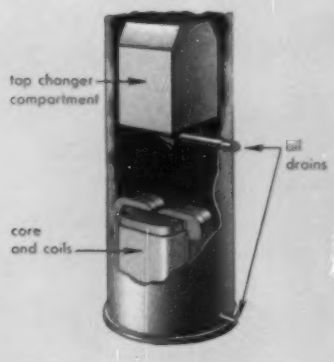
In the new Westinghouse Type URL-16 regulator, simplicity is the keynote — and savings the result. Every exclusive feature• works in some way to save you time — and money — in installation, operation, and maintenance.

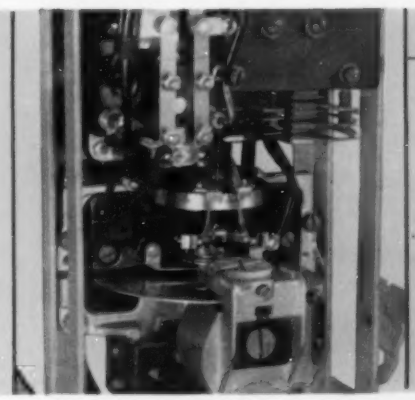
- **Domed, single-bolt cover** speeds internal inspections — eliminates corrosion-vulnerable hardware — provides a tighter, better seal.
- **Position indicator** can be reset from the ground with a hookstick — eliminates pole climbing.
- **Flexible, neoprene cable** links control cabinet and tank via simple, weatherproof, plug-in connections. Speeds installation of the control cabinet — remotely or on the tank. External mounting lugs eliminate opening the cabinet door when mounting or detaching.
- **New CJ-1 voltage regulating relay** uses an induction disc for closest control through true integration of voltage and time. The time delay is independently adjustable in a 10 to 40-second range — 6½ times greater than before. It has 1% accuracy — is interchangeable with previous CJ-1 models.
- **Long-life contacts can be inspected without untanking** — handhole is located directly over load tap changer contacts.
- **Transformer oil contamination is eliminated** by enclosing the tap changer in a separate compartment. Tap changer oil can be drained separately — only 2½ gallons of oil required.
- **Coastal Finish** doubles corrosion resistance under all operating conditions.

Other features that save time and money: new bushing cap and terminal provide universal connection to wire sizes ranging from #8 to 250 m.c.m., copper or aluminum; bolt-down lugs provide for platform mounting; source and load permanently identified on cover — simplifies installation.

YOU CAN BE SURE...IF IT'S

Westinghouse





Rated Voltages	System Voltages
2500	2500
5000	5000
	4330
	2500
7620	7960
	7620
	7200
	6900
	5000
	2500
13,800	14,400
	13,800
	13,200
	12,500
	12,000

Separate compartment for the tap changer allows tap changer oil to be drained independently. Eliminates periodic removal of carbon from the core-coil assembly.

New CJ-1 relay provides independent time delay adjustment while maintaining inverse time characteristic — true integration at all time settings.

Terminal board is incorporated in all units to provide suitable control voltage for system voltages, as listed in the table above.

New Westinghouse station step regulators

Revolutionary MAGAMP* control unmatched for maintenance-free reliability

Out of the Westinghouse engineering laboratories comes a truly significant advance in voltage regulators: MAGAMP (magnetic amplifier) controls. Proved first in motor control applications — available now on Westinghouse Types URS and URT station step regulators.

The Type MS voltage regulating control utilizes a MAGAMP sensing device that is completely sealed — has no moving parts — requires absolutely no maintenance. It has Class I accuracy — with all settings made by electrical components. Provision is made for determining band width without operating the regulator.

The Type TM time delay control utilizes a completely static timing circuit and a sealed, maintenance-free MAGAMP unit. Integrating time delay is provided in both "raise" and "lower" directions with a single setting of the delay knobs. Settings are adjustable in a 5 to 95-second range.

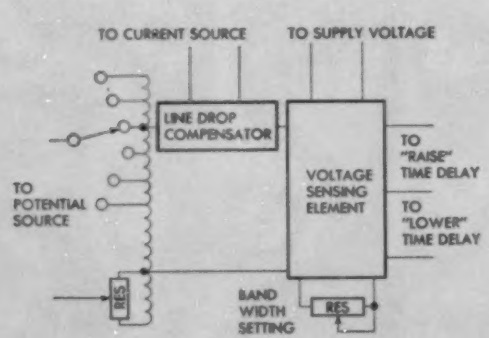
The time delay control actuates two auxiliary relays which operate the motor contactor. The life of these relays has been proved by test to be beyond 25 million operations — with no maintenance.

Virtually as maintenance-free as the MAGAMP controls are the direct-drive tap changers on these regulators. Geneva gear action of the moving contacts assures shockless acceleration and deceleration, with high speed during the arcing cycle. Tests have proved more than 8,000,000 operations without noticeable wear.

No wonder, then, we call the URS and URT regulators "Maintenance-Misers." In the industry today, no other station step regulators equal them for accurate regulation with minimum maintenance.

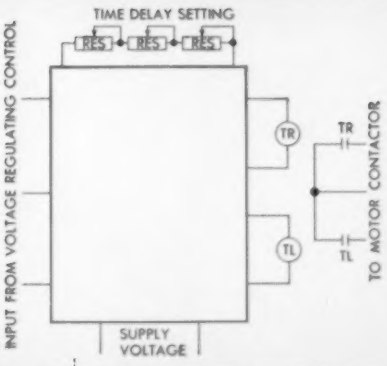
*Trade-Mark

YOU CAN BE **SURE**...IF IT'S
Westinghouse



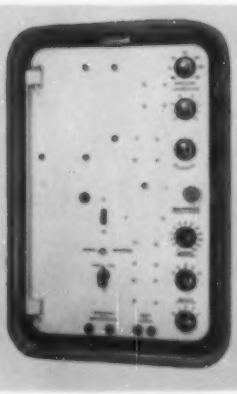
Type MS voltage regulating control takes up only two-thirds the space of the former SJS relay. The voltage sensing device is a static unit and is completely sealed. There are no mechanical adjustments—all settings are made electrically.

Herman Barsun, Section Manager, Regulator Engineering, calls your attention to the new MAGAMP control panel for station step regulators.

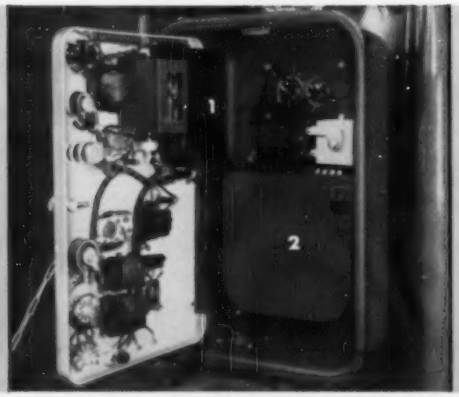


Type TM time delay control settings are made by means of the three delay knobs. Effective time delay is the sum of these three settings. The time delay element incorporates no moving parts—nothing to wear out, nothing to adjust.

J. B. Davidson, Supervisory Engineer, points out the MAGAMP control in the new Type SU induction regulator.



Control panel is molded of fiber glass, which gives light, strong construction with excellent insulation qualities.



Interior view of control cabinet shows simplified arrangement of components. MAGAMP devices for (1) voltage sensing and (2) motor operation are completely static, sealed units.

New combination cap and terminal give reduced over-all height and wide latitude in choice of leads—round, strap, horizontal or vertical take-off.

New Westinghouse induction regulators

Completely static MAGAMP* control spearheads improvements for better, simpler operation

To the inherent mechanical simplicity of induction-type regulators, Westinghouse now adds the revolutionary MAGAMP (magnetic amplifier) control and many other features for still greater ease of installation, operation, and maintenance. These are the new Types SU and SI, the greatest "Maintenance-Misers" in the induction regulator field and real money savers for you.

Completely maintenance-free reliability is assured with the new MAGAMP control — the first truly static control on any induction regulator. Completely sealed — with no moving parts — it achieves pin-point accuracy through electrical components that require absolutely no maintenance.

Operation of the new regulator over the full range has been extended from 35 to 70 seconds, while maintaining the 1 to 3-second correction from any normal fluctuation out of the prescribed band width. The band width, which is continuously variable between approximately ±½ to ±3½ volts, can be verified while the regulator is in service.

The new SU and SI regulators also include these simplified design features:

New round tank with domed, single-bolt cover eliminates cover hardware, speeds installation and inspection. Completely restrained gaskets provide tighter, more uniform sealing.

New bushing cap and terminal provide for a wide range in type and size of leads.

Fusite plugs for control leads through the tank wall provide leakproof construction and accommodate push-on terminals that eliminate all loose hardware.

New control cabinet features improved appearance and weather resistance. Door is hinged on the bottom providing a shelf for meters and drawings. Current and voltage test terminals are mounted on the front of the control panel for greater accessibility.

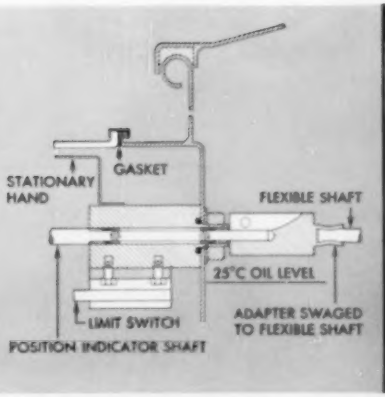
New position indicator includes a weatherproof housing, leakproof shaft seal and a reliable indicator drive.

Stator core mounting has been simplified for easier tanking and untanking.

**Trade-Mark*

YOU CAN BE **SURE**...IF IT'S

Westinghouse



Sectional view through tank wall shows the arrangement of the position indicator drive mechanism which assures trouble-free operation.

Fusite plugs for control leads incorporate a glass-to-metal seal—allow use of simple push-on terminals — eliminate all loose hardware.

Position indicator has weatherproof housing, is conveniently located for easy reading, and will give positive, trouble-free operation.

Only Westinghouse can supply you the RIGHT REGULATOR for each specific job

All things considered — initial cost, machine characteristics, and maintenance cost — no one type of regulator can satisfy all applications. This fact was recognized by Westinghouse over 40 years ago — when it became the only manufacturer to offer you a truly complete line of regulators.

For applications in the lower voltage ranges where frequency of operation is high, induction regulators, with their inherent mechanical simplicity, find a definite application. Induction types made by Westinghouse include the SU oil-immersed for pole and station applications, SI Inerteen®-immersed and SA dry-type for single-phase applications, and ST "Triplex" oil-immersed and STI Inerteen-immersed for three-phase applications.

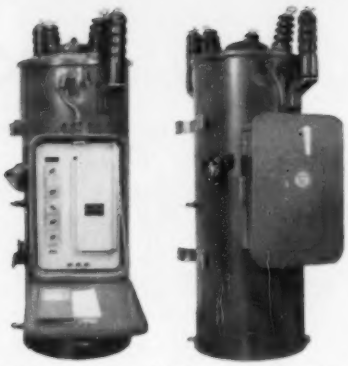
Step-type regulators find their application where operation is less frequent and regulation must be economically maintained. For pole-type applications, Westinghouse offers the URL-8 and URL-16; for higher voltage and current ranges, the URS and URT step regulators.

In both regulator types, Westinghouse design has consistently led the field for smooth, sensitive, trouble-free operation. With the introduction of the "Maintenance-Miser" designs, this superiority is even more notable.

So for the best in regulation whatever the application, look to the complete line of Westinghouse regulators. For complete technical and application data, call your Westinghouse sales engineer, or write to Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

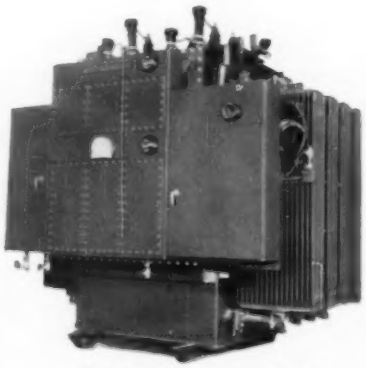
YOU CAN BE SURE...IF IT'S Westinghouse

J-70752

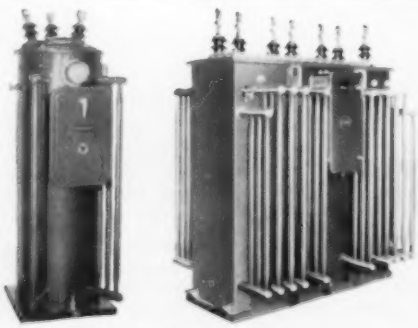


URL-8 and URL-16 pole-type step regulators

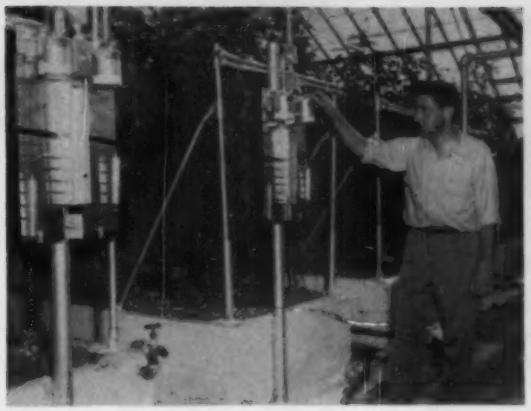
URS station step regulator

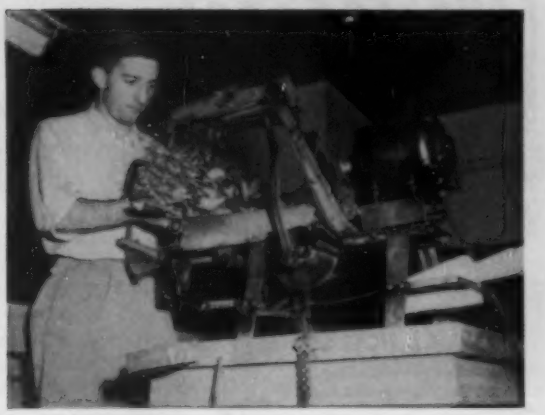


URT station step regulator



Induction regulators





Sensitive controls and fast, accurate bundling yield clues to why . . .

Roses Thrive on Electricity

BRUCE FEARN, Chalfont, Pa.

Gertrude Stein once wrote, "A rose is a rose is a rose." But at St. Leonard's Greenhouses in Bucks County, Pa., perhaps this line should read, "Electricity is a rose is a rose."

Here in a sea of 60,000 ever-blooming rose plants, Alfonso Sodano and son Connie create miracles in flowers. Roses were growing before man ever discovered electricity ". . . but not roses like these," says Sodano. "These roses were created through careful selection and breeding under the most precisely controlled conditions. Only electricity is sensitive enough to provide these conditions."

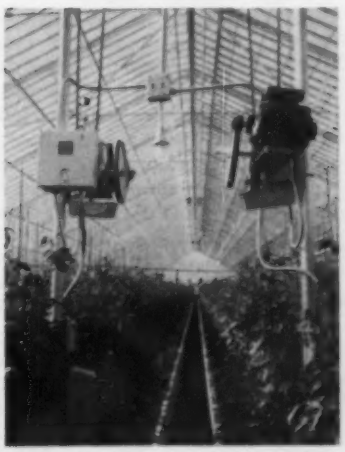
Growing greenhouse roses is work. It's walking up and down long aisles. It's handling thorned stems and soft blossoms. It's watering and spraying and cutting and sorting and packing. Each operation is ordinarily done by hand.

But years ago Sodano said: "I want to make this work easier for the men. I want not only labor-savers, but labor-helpers." He found his answer in electricity. Included in his wide variety of equipment:

- Electric controls to open and close, with the spin of a dial, the many ventilator sections at the roof peak of the great greenhouses. Thus as day and night alternate, so the temperatures inside the greenhouse climb and fall. But the temperatures act just right—often outdoing nature herself as far as roses are concerned. The controls can be worked at the main station or at subordinate points throughout the building.
- Electric bundlers to eliminate an onerous task for men who formerly tied the flowers into commercial bunches. The electric tying machine does the job even better and at a much faster speed.
- Three electric refrigerators to hold the proper temperature needed to keep roses primed for shipping.
- Electric ice-maker to turn out the flaky, light, chip-type of ice required to chill and support roses during shipment.
- Electric power to drive the coal stoker, to light the oil burners, to warm the oil pipelines, and to tote tons of coal to the top of the great coal silo, then dump it in.
- Other machines, such as electric water pumps, heat circulators, and boiler cleaners.

This electric foundation for a flower business makes economic sense. Perhaps it is best summed up by the wag who, upon hearing of this progressive layout, remarked: "Why life for those guys must be several beds of roses."

(*More S&S on page* 154)



AFTER CONNIE SODANO sets controls, these small motors adjust ventilation

TWO BOILERS make up heating plant. One uses oil, the other works on coal

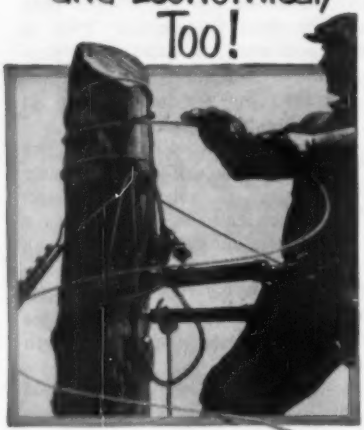
Crapo
GALVANIZED STEEL
STRAND

Strong...
to support pole structures under adverse ice and wind loadings.

Rugged...
to withstand the punishment incurred in construction and service.

Long-Life...
provided by famous Crapo Galvanized heavy, ductile, tightly-bonded zinc coatings.

-and Economical, Too!



● Each size and grade of time-proved Crapo Steel Strand utilizes the superior tensile strength of steel to the fullest advantage. Next time, specify Crapo Steel Strand for guys, messenger and overhead ground wires . . . and save on maintenance!

REINFORCE and PROTECT YOUR CONDUCTORS with Preformed ARMOR RODS

Minimize wear and chafing . . . Absorb and dissipate vibration . . . Protect against arcing and flash-overs . . . Increase holding power against slippage . . . Lessen possibilities of corrosion . . . Reduce overall maintenance costs.

Contact your jobber of Crapo Galvanized Products or write direct for further information!

INDIANA
STEEL & WIRE COMPANY
MUNCIE, INDIANA

SALES—Commercial, Industrial

Lamps Clean Water

Ultraviolet rays from bactericidal units sterilize water at economical cost

Contaminated water can be economically sterilized by exposure to ultraviolet radiation.

Recent experiments with powerful bactericidal lamps have confirmed that such sources of ultraviolet light are practical for water sterilization, reports Dr. Rudolph Nagy of the research department of Westinghouse Electric Corp's Lamp Division.

Big Demand

"In addition to the many communities in the world that do not have supplies of potable water, there are numerous industrial processes that require pure water that has not been chlorinated," Dr. Nagy said. "Such firms as dairies, breweries, bottling plants and pharmaceutical houses cannot use chlorinated water, and since ultraviolet radiation does not impart taste or odor, or produce chemical changes in the water, it is ideal for water purification.

Dr. Nagy described the results of exhaustive laboratory tests made to determine the amount of ultraviolet radiation required to sterilize a given amount of water in a specified time. "Of course it depends on the degree of initial contamination and the purity of water required," he explained, "but in general it can be said that in the case of 'average' water, up to 750 gal an hour of potable water can be produced with a 40-w bactericidal unit, of the type produced by Westinghouse.

What Is Average Water?

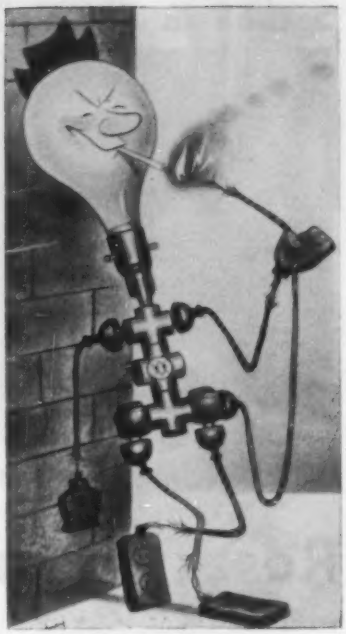
"Average water is that containing a normal amount of organic matter and iron salts, both of which absorb ultraviolet radiation and consequently influence its sterilizing effectiveness," Dr. Nagy said. "Common alkali salts don't absorb ultraviolet and so needn't be considered in this respect.

"Another factor affecting sterilization is the temperature of the water, because it directly affects the ultraviolet output of lamps. The colder the lamp, the less ultraviolet it produces, and a lamp operating at 105 F will produce about four times the radiation of one operating at 50 F. Higher operating temperatures can be obtained if desirable," Dr. Nagy pointed out, "by encasing the lamp in a quartz 'jacket' or outer tube.

"Although ultraviolet radiation from mercury arcs has been used since 1909 for the sterilization of water, the cost of this method greatly exceeded that of chlorination and therefore limited its use," he explained. "Recent advent of the efficient, inexpensive, and long-life ultraviolet bactericidal lamp has made the technique economically practical.

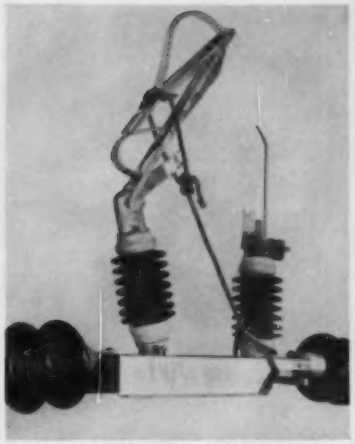
"This economical method of sterilizing water meets the requirements of Public Health Service drinking water standards," Dr. Nagy said, adding the prediction that, "it should find wide application in homes and factories. No longer will the public and business have to rely on chlorination to provide potable water so necessary to human and industrial life."

(*More S&S on page* 158)



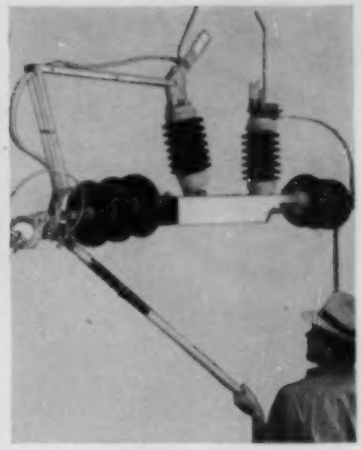
AW's Delinquent

Meet "Skimpy"—Skimpy Wiring—new cartoon character developed by Kennecott Copper Corp to help dramatize the inadequate wiring dilemma. Kennecott will use the cocky little electrical delinquent in its continuing AW advertising campaign, now in its second year.



1. Raised pantograph is tied back to base of second insulator preparatory to installation on "jumped" energized line.

2. An eye on the side of the linkage permits pantograph to be lowered with a clamp stick to attach it to the contact.



3. Contact terminal nuts of Chance Type VN Switch are tightened with a hot stick wrench to secure the pantograph.

CHANCE *Tilting Insulator* SWITCHES

are easy to "cut in hot" or to isolate for *safe* hot line maintenance

Chance WN or VN Switches can be installed "hot" without service interruption and can be readily isolated for insulator changes or repairs. The two-insulator switch (Type VN) has a simple sliding connection that overcomes the problem of isolating the pantograph end of the switch. The three steps pictured above show how this Chance Switch is isolated for installation or repair.

Chance Type WN (three-insulator) Switches are also easy to isolate. Two simple methods are shown below.

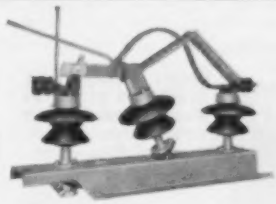
But Chance WN-VN Switches offer many other advantages:

Blades are always in alignment and make positive contact under all conditions—due to compensator control.

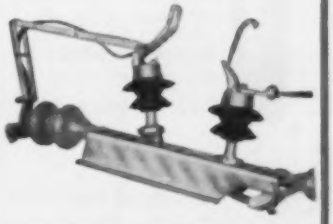
They open and close readily—even after the heaviest ice storms.

They are easy to install. The interphase shaft clamps into position without laborious "threading".

Get the whole story. Ask your Chance Representative or write for Catalog information and test data.



Chance Type WN Switch.
Three-insulator gang operated switch. 7.5 to 46 KV—200, 400, 600 amps.



Chance Type VN 200 amp. Switch.
A two-insulator tilting type switch built for service and economy. 7.5 to 34.5 KV.

Isolating Type WN Switches

The upper photo at right shows how a tap clamp is attached to the jumper so it can be handled with a clamp stick while nuts are loosened with a hot line wrench. The jumper may then be removed and attached to the conductor with another clamp or held with hot sticks. The jumper can be easily rethreaded when work is completed. Another method is shown in the lower photo. A short bus bar, attached to the terminal when the switch is installed, enables easy removal of the jumper for isolating the switch.

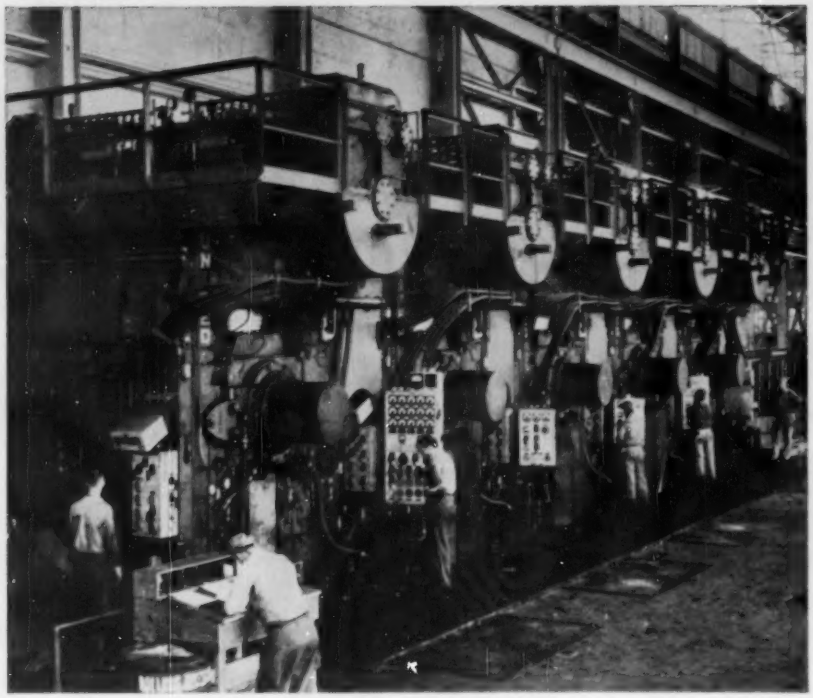
A·B·CHANCE CO.

CENTRALIA, MISSOURI • San Francisco, California

(In Canada: A. B. Chance Company of Canada, Ltd., Toronto 13)

ABC INDUSTRIES

CS55-13



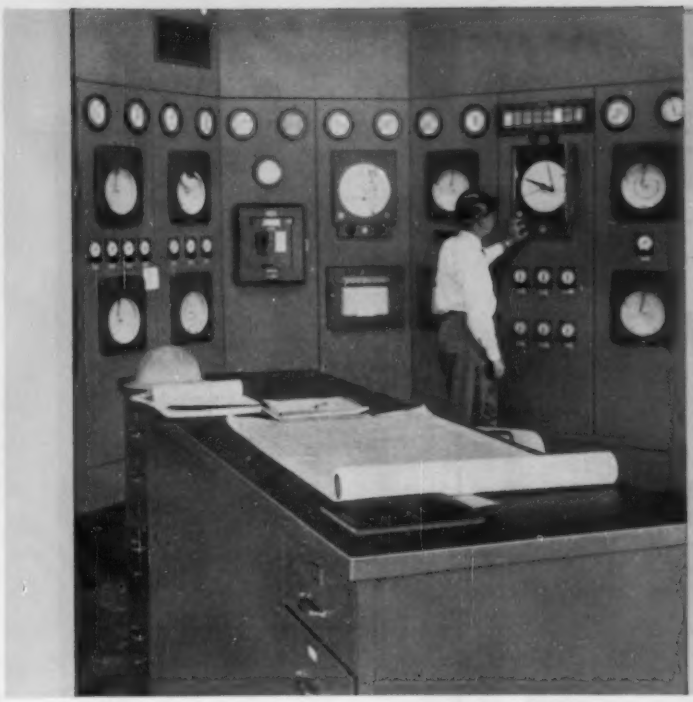
In industrial applications such as this five-stand cold reduction mill control cable circuits are vital. Control (and power) cables must withstand high operating temperatures, acid fumes, oils, abrasives.

Protected against *moisture, chemicals and*

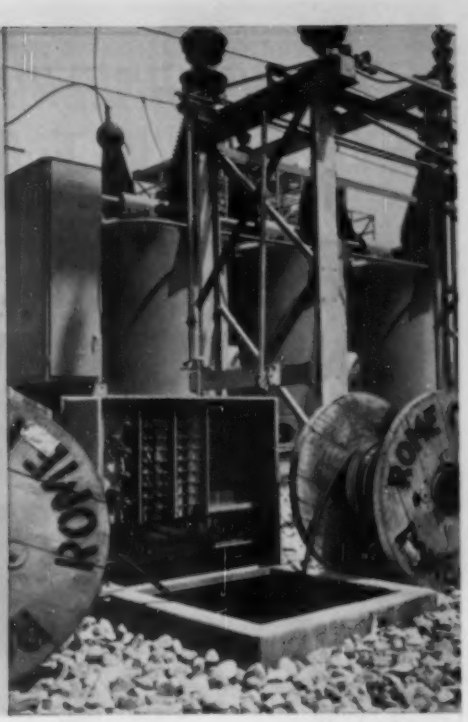
RoZone® insulated-RoPrene sheathed station control cable. The ultimate in control cable design and performance. Individual conductors are insulated with RoZone, oil-base, ozone-resisting insulation—and each individually insulated conductor is protected by an all-resistant color-coded Neoprene sheath. Rubber-like fillers prevent wicking of moisture, and a Neoprene sheath provides over-all protection. Maximum operating temperature, 75° C. Fully described in Rome Cable Specification CRO-1.

RoMarine insulated—RoPrene® sheathed station control cable. A moderately priced, high-quality, general-purpose design. Individual conductors are insulated with RoMarine, heat- and moisture-resistant insulation, and identified by color-coded fabric braids. Fillers are jute, with an over-all sheath of Neoprene. Fully described in Rome Cable Specification CRM-1.

RoLene insulated—Rome Synthinol® or RoLene sheathed general-purpose control cable. An all-thermoplastic construction with RoLene (polyethylene) color-coded insulation, fillers and an over-all Rome Synthinol or RoLene sheath. Reliable, high-quality control cable at low cost. Smaller diameters than other constructions. Fully described in Rome Cable Specification CT-2.



Permanent, clear color coding of individual wires for quick circuit identification is assured when you specify Rome Control Cables.



You get flexibility of installation with Rome Control Cables. Install them in ducts, direct burial in earth, aerially, in racks, conduit or trays.

oils, corrosive fumes, vibration, wear and abrasion

Control cable circuits play a more important role every day. As more and more utility and industrial operations turn to remote control, continuous processes and other forms of automation, the results of a control cable failure become more costly.

After you've determined your circuit requirements, and made note of operating hazards which could affect circuit reliability, you'll need to find a correctly engineered cable construction.

The right construction should give you at least four things:

① the best possible circuit protection

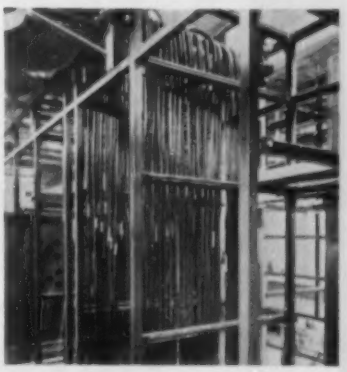
② bright, clear circuit identification colors that are permanent

③ flexibility of installation (i.e., in ducts, conduit trays, racks, direct burial in earth, or aerially)

④ the lowest practical cost consistent with your needs

You get all four with each of the three standard Rome Control Cables discussed at left. Further, a variety of constructions, involving special arrangement of sizes, coverings and method of assembly, can be furnished to your specification.

If you have questions, want detailed specifications or application engineering help, write, wire or phone. Rome Cable's many years of specialization in the engineering, research and manufacture of station, supervisory, telemetering or signal control cables is your insurance against the high cost of control cable failure.



Neat installations are readily made with Rome multi-conductor or single-conductor control cables, sheathed with Rome Synthinol, RoLene (polyethylene) or RoPrene (Neoprene).

It Costs Less to Buy the Best

ROME CABLE Corporation
ROME • NEW YORK
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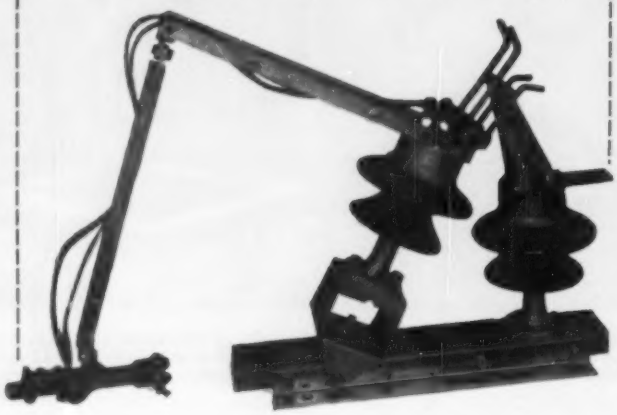
TORRANCE • CALIFORNIA

GOOD ENGINEERING PLUS EXTRA SERVICE FEATURES

IN THE

ROYAL Type AL-2 TILTING INSULATOR SWITCH



FOR substation or pole-top mounting, Royal's Type AL-2 Tilting Insulator Switch is husky and economical. Like all other Royal group-operated switches, the AL-2 has high-pressure beryllium contact rods which are individually self-adjusting. This feature compensates for any mis-alignment of the interphase shaft which may occur. In both open and closed positions, positive stops against the switch base are provided by the insulator adaptor.

The pantograph assembly can be adjusted to swing for any angle up to 45°, thus saving an extra pole sometimes needed when the conductor comes in at an angle. Another popular money-saving feature is the new dead-end clamp supplied as an integral part of the switch. This saves installation time and has quadrupled the holding power of the strain assembly.

The AL-2 switch is available from 7.5 to 46 kv in current ratings from 200 to 1200 amp.

Royal

A Part of the Arsenal of AMERICAN POWER PRODUCTION

ROYAL ELECTRIC MANUFACTURING COMPANY

INCORPORATED

1122 EAST 97th STREET Chicago 19, Ill.

"Be a Better Cook"

Look magazine is inviting utilities and their dealers to tie-in with its nationwide appliance promotion, "Be a Better Cook . . . and Housekeeper, Too", scheduled to break Sept. 26. Merchandisers participating in the promotion will receive a 28-piece kit containing point-of-sale material, ad heading mats, and radio-TV commercials. Special recipe booklets for give-away to prospects also are offered. Magazine, itself will back up the promotion editorially with a home living article on cooking in its Oct. 4 issue.

Kits at $2 each and cookbooks at $5 per hundred can be ordered directly from Dick Harmel, Merchandising Manager, Look, 488 Madison Ave, New York, N. Y. July 20 is the closing date for orders.

S & S SHORTS

More Mass Sales of Heat Pumps

On the heels of Southern California Edison Co's success (EW, June 13, p 134), Ohio Power Co has announced 80 heat pump-equipped homes will go up in a new housing project at Lima, Ohio. Price-tagged at $16,000 to $18,000, the homes also will have water heaters, dishwashers and garbage disposers. Electric ranges, dryers, freezers and refrigerators will be optional. The project is believed to be the largest single residential installation of heat pumps in the northern states.

AW to Get Electrical Show Plug

"Safety Through Adequate Wiring in American Homes and Business" will be a theme of 3rd National Electrical Show set for Oct. 11-14 at 69th Regiment Armory in New York. Sponsored by Eastern Electrical Wholesalers Association, show will feature displays of latest technical and appliance developments.

New Items:

A new 1½-hp, 230-v room air conditioner, designed to cool areas up to 1,000 sq ft and operating with a high power factor motor, is being put into production by General Electric Co . . . Hotpoint Co has introduced a new refrigerator-freezer equipped with rollers which permits it to be moved from position for easy cleaning.

Another Utility Case History

Since 1939: thousands of poles preserved with low-cost PENTA

Since WISCONSIN POWER AND LIGHT COMPANY installed its first Penta-treated pole 16 years ago, the company has placed nearly 15,000 more Penta-treated western red cedar and southern yellow pine poles, and countless western fir crossarms, in southern Wisconsin. Today, even the oldest of these units are as good as new, have *many more years* of service ahead of them—an impressive example of lasting Penta wood protection!

ELIMINATE REPLACEMENT OF CROSSARMS WITH PENTA

Not only does it cost $5 or more to replace a single crossarm, but consider the trouble and expense of freighting timber, working "hot" lines, switching attachments to thousands of new crossarms a year! Penta eliminates crossarm replacement by protecting wood against rot and insect attack. Crossarms treated with Penta last the 30-year lifetime of a pole! And the cost of preserving wood with Penta is surprisingly low, in fact the cheapest insurance you can buy!

SPECIFY PENTA PROTECTION for Poles . . . Crossarms . . . Transformer Platforms . . . Braces . . . Control Boxes . . . Planking. Mail coupon below for list of more than 85 treating plants that will apply Penta for you, and for FREE Penta booklet, "Poles and Crossarms."

PENTA-TREATED WOOD DOESN'T BURN HANDS

Penta stays locked in wood, can't bleed or leach out! That's why Penta-treated wood is clean, can't "burn" hands or stain clothing.

MONSANTO
CHEMICALS – PLASTICS

SERVING INDUSTRY, WHICH SERVES MANKIND

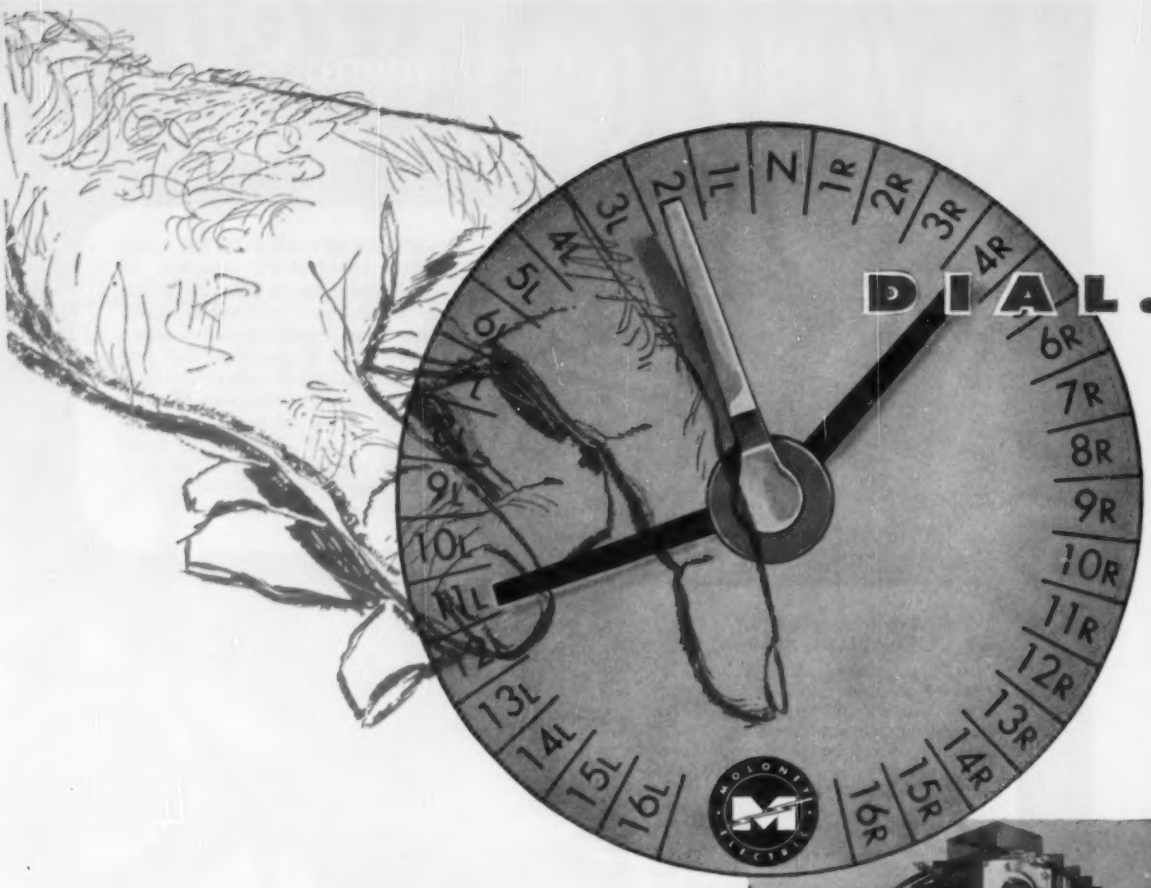
Organic Chemicals Division
MONSANTO CHEMICAL COMPANY
Box 478-D-6, St. Louis 1, Missouri

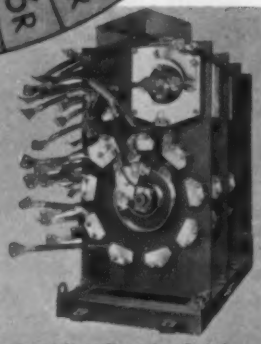
Please send: ☐ List of Penta-treating plants
☐ FREE "Poles & Crossarms" booklet

Name .....

Address .....

City ..... *State* .....





Moloney Load Tap Changing Switch mechanism provides continuous full load operation at any operating point. Can safely handle short circuits or ground faults reaching 25 times full-load.

SEND FOR
BULLETIN NO. LTC-2907

M O L O N E Y E L E C

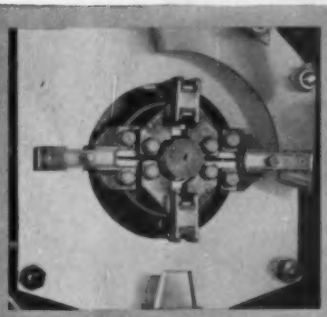
Power Transformers • Distribution Transformers • Step Voltage
Load Center Transformers • Unit Substations • Network Transformers

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES

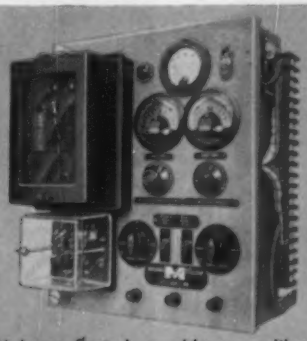
. . "M" FOR MOLONEY

The dial on your load tap changing equipment not only tells what position is being tapped, buck or boost, and the lowest and highest position reached . . . it also tells whether or not you dialed "M" for Moloney . . . the most dependable regulating equipment you can buy. Right there is the familiar Moloney Trademark, your assurance of dependable, trouble-free long operating life. Learn why the Moloney "M" has become the "Sign of Quality" to utilities everywhere.

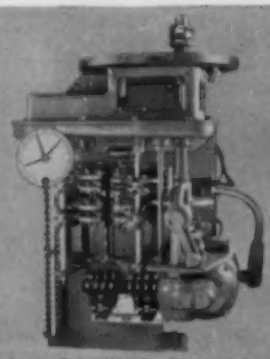
MEDD-4



Moloney Load Transfer Switch combines by-passing of switching reactor during full cycle position with rugged current interrupter. All arcing tips are easily accessible for quick maintenance.



Moloney Controls provide a sensitive voltage regulating relay, with a wide range line drop compensator to give a perfect balance between voltage diviation and regulating equipment.



Moloney Drive Mechanism contained in an accessible weatherproof compartment has noncorrosive or protected parts to resist atmospheric conditions.

T R I C C O M P A N Y

Regulators • Regulating Transformers • Load Tap Changing Transformers
Constant Current Transformers • Capacitors • Transformers For Electronics

AT ST. LOUIS 20; MO. AND TORONTO, ONT. CANADA

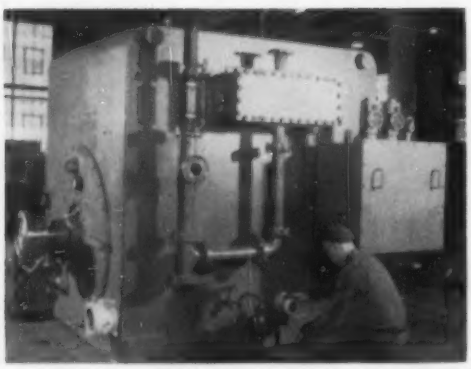
NEW EQUIPMENT

Safety Belt

Lineman's safety belt is said to eliminate the hazard of falling out of the saddle, thus permitting the lineman to be higher on his work. As a result he can work further out from the pole with greater comfort and freedom, says the manufacturer.

"Bak-Saver", as it is called, is claimed to combine the protection of a safety belt with the comfort of a back support. Support portion of the belt is made from high quality russet strap leather and is ventilated for comfort. Tool saddle and dee saddle are made from russet steer harness leather for maximum strength.

Miller Equipment Co, Inc, Franklin, Pa.



Gas-Filled Motors

Totally-enclosed, inert gas-filled motors are designed for safe operation in hazardous gas-contaminated areas.

Gas enclosures utilize air-to-water surface heat exchangers to cool the motor. Under positive pressure, the non-explosive gas in the motor keeps out volatile ambient gases that could cause an explosion.

Plate steel stator yokes are welded at all joints to keep gas replacement to a minimum. Special equipment includes a gas pressurizing manifold to maintain pressure in the housing, explosion-proof instrumentation for temperature detection, liquid level alarm and water-flow metering. (Motor illustrated is rated 3,000 hp, 2,300 v, 1,800 rpm.)

Allis-Chalmers Mfg Co, Milwaukee 1, Wisc.

Indoor Current Transformer

Current transformer for indoor service has been designed with extra high mechanical and thermal ratings to adapt it for relay and control device operation. It is made for use on circuits up to 5,000 v, line-to-line, and is available in all standard, single, primary-current ratings from 15 to 800 amp.

Type JKS-3 is butyl-molded. This construction is said to provide an insulation that resists oxidation, arc-tracking and moisture. Butyl will not crack from coil expansion or from wide ambient temperature changes.

Transformers will operate continuously at 100% of rated current in a 55 C ambient without exceeding allowable 30 C rise, says the manufacturer.

General Electric Co, 1 River Rd, Schenectady 5, N. Y.

You save money by using non-rusting Copperweld* Strand because you pay for only one guy installation during the life of the pole — costly replacements are eliminated. Certainly, this is important — for to replace just one rust-weakened or broken ordinary guy may cost you $100 or more, when you figure the outage and the items of labor, fittings and truck time—plus the cost of the new strand.

Once you put Copperweld Strand up, it's up to stay—its original high tensile strength remains permanent. When you consider its extra staying power, longer life and low overall cost, Copperweld is the most dependable and economical strand you can buy.

*Trade Mark

COPPERWELD STEEL COMPANY

WIRE AND CABLE DIVISION, Glassport, Pa.

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

1955--our 40th year

when it
comes to
line clearance
BRUSH KILLERS
you name it . . .
THOMPSON
makes it!

Thompson, one of a handful of America's basic manufacturers of selective herbicides, makes every type of proven efficiency — ready for your use — whether you employ foliage spray, basal bark or stump treatment.

LOW VOLATILE

BRAMBLCIDE 5 — L. V. 2,4,5-T

BRAMBLE-WEEDICIDE 5 — L. V. 2,4-D — 2,4,5-T

CONTROLLED VOLATILITY

BROAD SPECTRUM — PENTYL ESTERS

BRAMBLCIDE

BRAMBLE-WEEDICIDE

BRAMBLCIDE 5

BRAMBLE-WEEDICIDE 5

BROAD SPECTRUM . . . or LOW VOLATILE . . . whichever you prefer, Thompson's delivers *more kill per gallon* because every gallon is fortified with a new and exclusive surfactant perfected in the Thompson laboratories. No other "creeping agent" duplicates its performance.

MORE GALLONS PER DOLLAR . . . when you specify Thompson you get a finished product from the basic producer . . . your most economical method of buying.

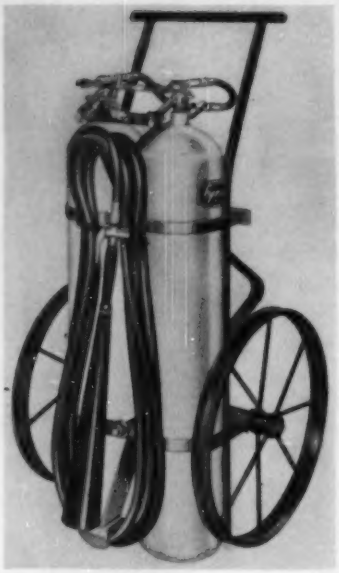
for most efficient kill at lowest cost*

SPECIFY . . . Thompson Chemicals FIRST NAME IN BRUSH KILLERS

Write for station paper 19. It provides latest research on right of way herbicides, their selection and application.

THOMPSON CHEMICALS CORP.
St. Louis 3, Mo. Los Angeles 27, Calif.

agents in principal cities



Fire Extinguishers

Carbon dioxide wheeled engine fire extinguishers are for use on large fires in oil, gas and other volatile liquids as well as live electrical fires.

Cylinders are capped by lever operated valves to permit immediate discharge of the liquid carbon dioxide. Twin 50 lb cylinders on a 100-lb model (illustrated) can be operated independently of each other, or in tandem.

The units are made in 50, 75 and 100 lb capacity models.

Fyr-Fyter Co, 221 Crane St, Dayton 1, Ohio

Mobile Radio

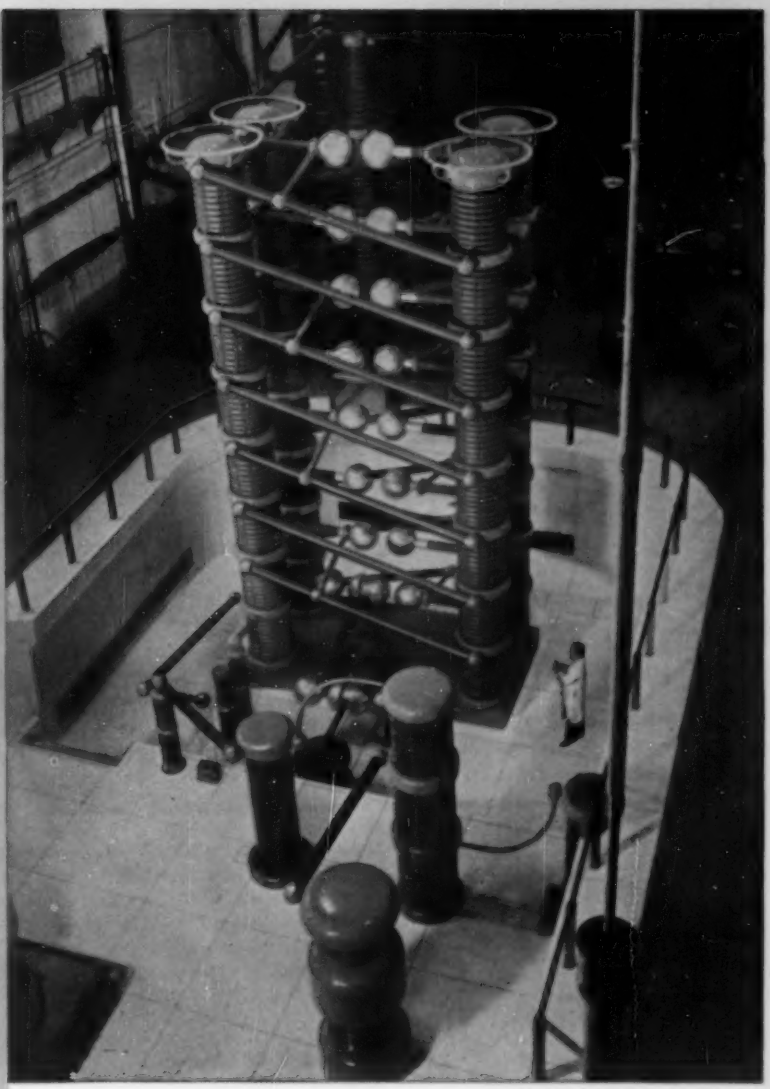
Extended communication range is provided by a standard two-way mobile radio unit which is capable of transmitting up to a 110-w signal. It is the latest addition to the "Progress Line" of radio communication equipment and operates in the 25-50 mc band. The unit consists of a separate transmitter, receiver and power supply chassis connected by electrical cables terminated in standard plugs and receptacles. It can be mounted under the dashboard or in the trunk and may be switched between vehicles having either a 6 or 12 v dc system, without alterations.

General Electric Co, Electronics Park, Syracuse, N. Y.

(*More New Equipment on page* 166)

Transformer Capacity of over 5,000,000 kVA per annum

The Ferranti transformer plant at Hollinwood, Lancashire, England, covering an area of over 300,000 sq. ft., has a manufacturing capacity per annum of over 5,000,000 kVA of Large Power Transformers, Distribution Transformers, Voltage Regulators, High Voltage A.C., D.C., and Impulse Testing Plant and Specialised Equipment. Contracts include the supply of transformers for the Garrison Dam and McNary Dam Projects in the U.S.A. and the Alcan Project in Canada.



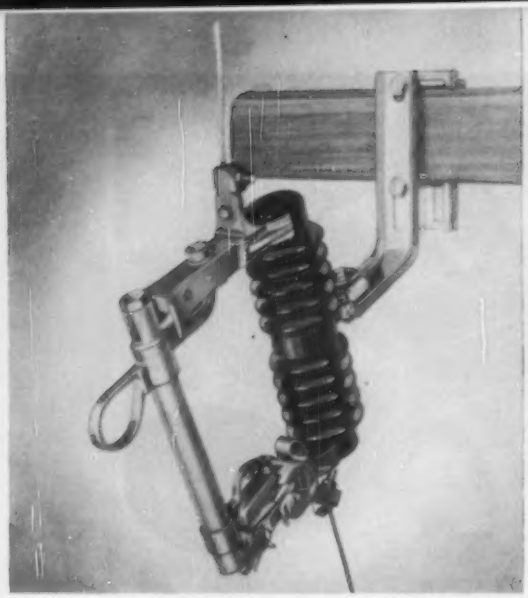
National Physical Laboratory

This Ferranti Impulse Generator at the National Physical Laboratory, Teddington, England, by whose permission the photograph is reproduced, generates 3,200,000 volts and has an energy rating of 77 kW seconds. This is a typical example of the type of A.C. and D.C. equipment manufactured by Ferranti Ltd., for routine and research testing.

FERRANTI LTD *Head Office and Plant:* **HOLLINWOOD · LANCASHIRE · ENGLAND**

OFFICES AND PLANTS FT 160

NEW YORK: Ferranti Electric Inc., 30 Rockefeller Plaza, N.Y. 20
TORONTO: Ferranti Electric Ltd., Mount Dennis, Toronto 15, Ontario
MANCHESTER, ENGLAND Ferranti Ltd., Moston, Manchester 10
EDINBURGH, SCOTLAND Ferranti Ltd., Ferry Road, Edinburgh 5



Fuse Cutout

Heavy-duty interrupting capacity trip-out, open-type, fuse cutout has both double venting and a fully weather protected top contact. Top gas vent is located in front of cartridge casting to direct expulsion gasses away from all live equipment and leads to prevent flashover.

Cartridge recoil of the Type G cutout acts to keep upper contacts closed during arc interruption to prevent arc burning. Design of full-floating upper contact provides high pressure, constantly aligned contacts and absorption of cartridge thrust. Standard button head fuse links are used.

Type G is rated 100 amp at 7.8 and 15 kv.

James R. Kearney Corp, 4236 Clayton Ave, St. Louis 10, Mo.

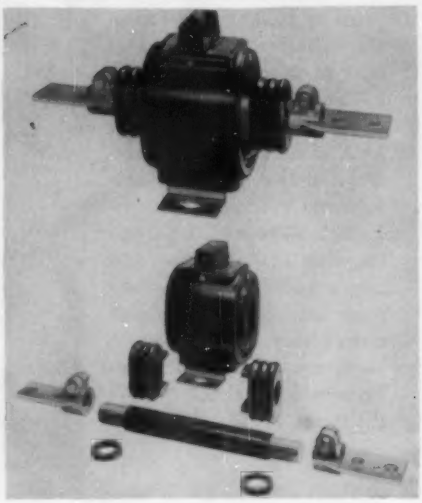
CT Conversion Kit

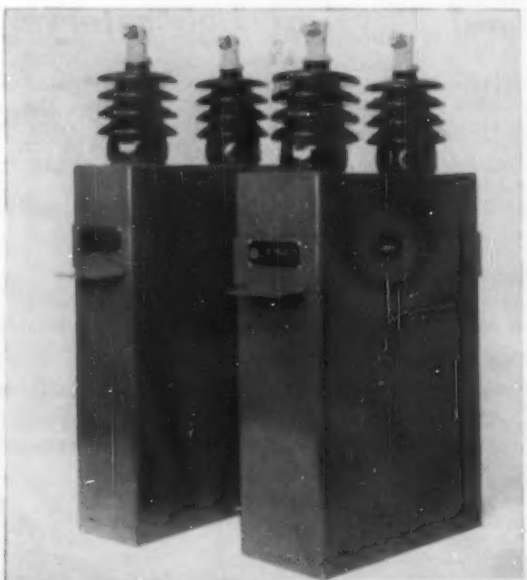
Conversion kit transforms window-type 600-v, indoor-outdoor, current transformers to 5,000-v insulation class bar-type units. The kit is expected to enable users to save on light duty metering transformer stock requirements and reduce the cost of 5,000-v units, says the manufacturer. For outdoor service, it is said to simplify handling since weight and size of CTs is considerably less.

Supplied in the kit are: A primary copper conductor rod insulated by epoxy resin and threaded at both ends, two primary bushing inserts (epoxy resin cast) and terminal pads, and gaskets and instructions. The primary terminals hold the entire assembly together.

Converted units have withstood 5-kv insulation class, 60 cycle and impulse tests. Basic 600-v window-type CTs, which are also epoxy resin cast, are available in 200-5, 400-5, 500-5 and 800-5 amp ratings.

Allis-Chalmers Mfg Co, Milwaukee 1, Wisc.





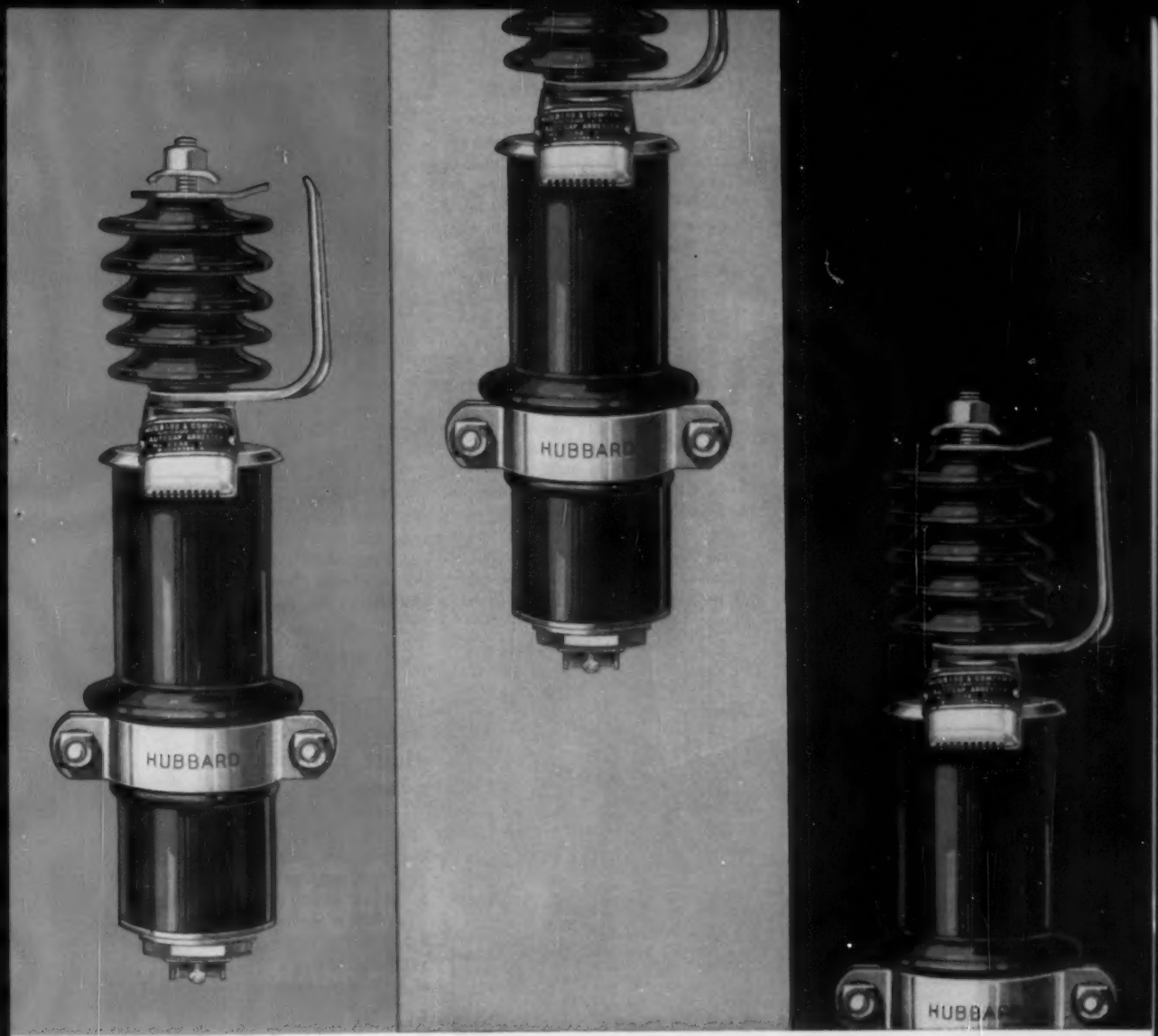
Power Capacitor

High-voltage power capacitor, rated 33⅓ kva, (at right in photo) is designed to meet the demand for larger concentrated blocks of reactive kva at lower weight and cost levels, according to the manufacturer. Capacitors of this rating will provide 300 kvar with nine units as compared to the usual twelve 25 kvar units presently required. If desired, twelve units of this rating can be used to expand pole mounted installations to 400 kvar blocks as against a maximum of 300 kvar now possible.

The increased rating has been obtained by a more optimum use of paper laminations, says the manufacturer. Width of the unit has been increased slightly over the company's 25 kvar unit (illustrated at left) but the height is the same. The new units will fit in the manufacturers circular pole rack which was announced recently.

Capacitors rated 33⅓ kvar are available in standard voltage ratings from 2.4 to 7.96 kv.

Cornell-Dubilier Electric Corp, South Plainfield, N. J.



Hubbard Autogap Lightning Arresters prove most reliable

Since their introduction 15 years ago, Hubbard Autogaps have enjoyed a record of practically trouble-free service in every state, under every conceivable type of weather and storm.

One reason for this fine record is the Autogap's exclusive dual exhaust, which dissipates extreme pressures harmlessly and quickly. In addition, the Hubbard Autogap is designed to pass the discharge over an innumerable choice of paths. This prevents the burning and consequent loss of efficiency caused by the discharge following the same path each time the arrester operates.

Impartial tests, conducted by utilities as well as by an independent research laboratory, have proved Autogaps to be superior to any other lightning arrester on the market. If you're not already among the thousands who have Hubbard Autogaps in service, call your electrical distributor or Hubbard representative and investigate the real economies and protection you too can get with the Hubbard Autogap.

As an expression of confidence in the Hubbard Autogap Lightning Arrester, Hubbard and Company now offers a five-year warranty on each Autogap. Details of this warranty are shown in the certificate at right.

WARRANTY

"Hubbard & Company warrants this Autogap lightning arrester against failure resulting from defective material or workmanship for a period of five years and will provide a new unit without charge upon return of the defective unit within such period. This warranty, however, does not include replacement labor costs or consequential damages of any kind."

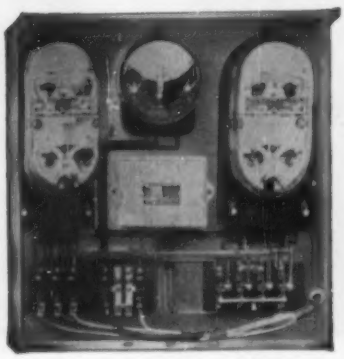
HUBBARD AND COMPANY

Pittsburgh 1, Pa.
Chicago 50, Ill.
Oakland 8, Cal.

KEES

POLYPHASE METER BOXES

L16-W



No. 24-W-2 FRONT REMOVED

KEES polyphase outdoor meter boxes feature knockouts for all probable hook-ups for polyphase meters, primary metering, time switches, and recording instruments. Front forms more than one-half the sides and bottom. Equipment can be reached from sides as well as from front. Weatherproof, waterproof front is hinged at top, easily detached. Latch may be sealed, and locked.

Write P. O. Box 566 for free catalog.

SINCE 1874

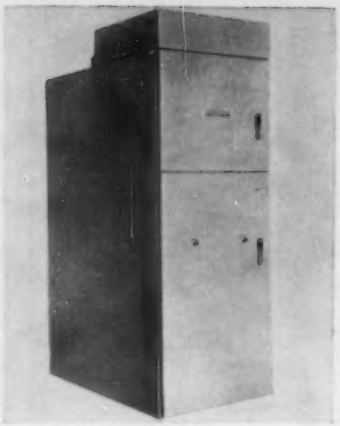
F.D. KEES MANUFACTURING CO.
BEATRICE, NEBRASKA

High-Voltage Starters

High-voltage starters can be used on systems having a maximum fault capacity of 150,000 kva at 2,300 v or 250,000 kva at 5,000 v. They are available in ratings up to 1,500 hp at 2,300 v and 3,000 hp at 5,000 v for both induction and synchronous motors. Featured in the starters are 400 amp current limiting fuses, new air break contactors and new enclosures.

Current limiting fuse is a single unit with a single mounting. It is said to interrupt faults in less than one-half cycle. Contactor, in ratings of 200 and 400 amps, is capable of interrupting 50,000 kva at either 2,300 or 5,000 v. Arc boxes are hinged-mounted to permit easy access to arcing contacts without removing other parts.

Enclosures, built to a standard depth of 60 in., are said to be up to 46 in. narrower than previous designs.



Mechanical interlocks between both oil immersed and air break contactors and the fuse compartment door, assure personnel safety.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Hoist Support

"Magic-pole A-frame" is a portable "skyhook" for supporting hoists. It handles 2 tons, has a working height of 10 ft, and weighs 43 lb. The two legs fold together and telescope to a length of about 6 ft. A single guy line with a maximum pull of about 1,000 lb can be attached to any convenient support.

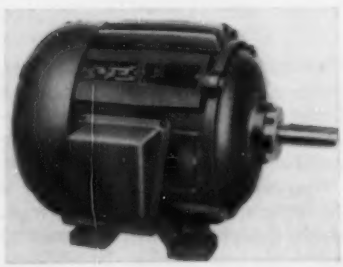
B. E. Wallace Products Co, Exton, Pa.

Totally-Enclosed Motors

Standard and explosion-proof totally-enclosed motors feature corrosion-resistant cast iron frames, improved winding insulation and heavy-duty ball bearings.

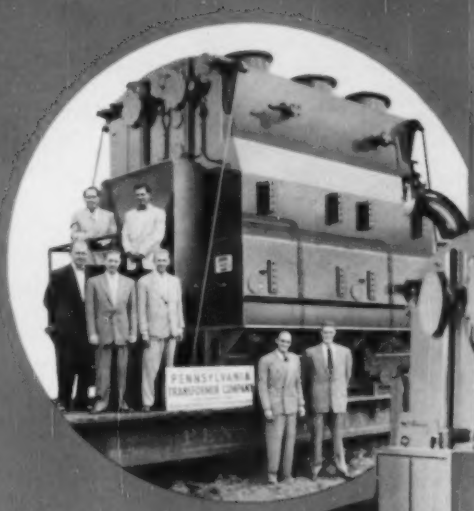
Grease fittings are provided at top and bottom of bearing housing to permit lubrication and removal of old grease. A running shaft seal is installed on each end of fan-cooled motors and on the drive end of non-ventilated motors. Aluminum squirrel-cage rotors are dynamically balanced.

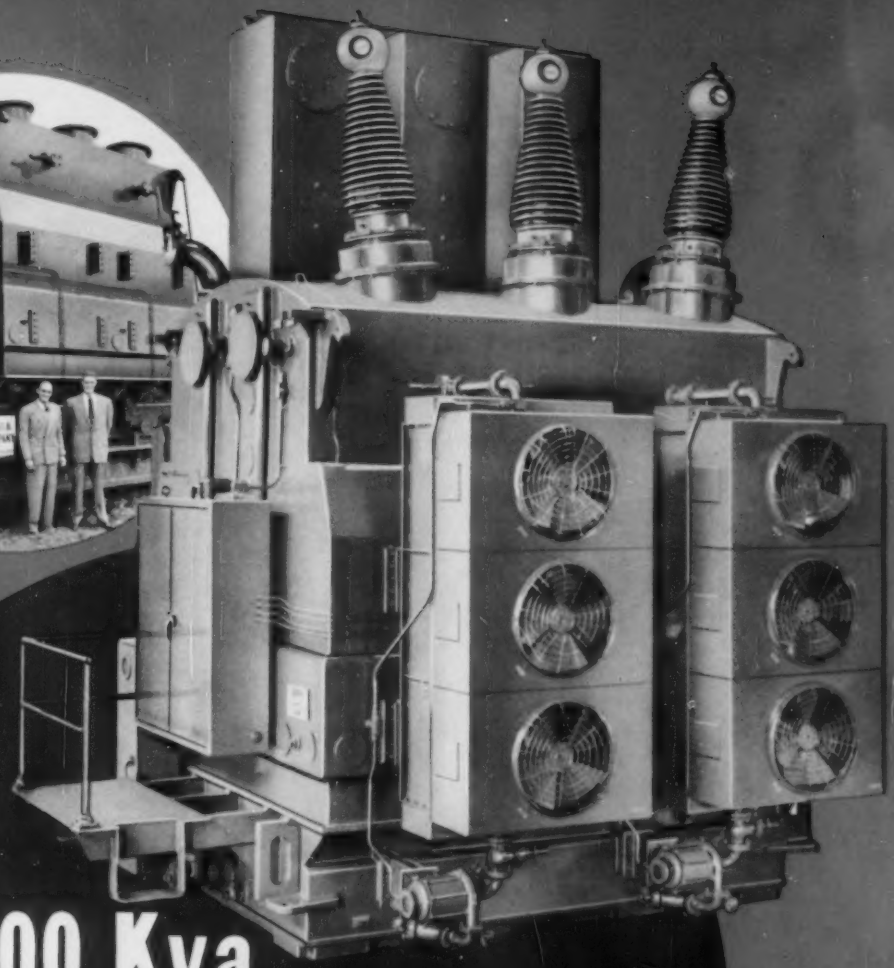
Motors are available in ratings from 1 to 10 hp, 4 pole, 60 cps, in rerated



NEMA frames 182 through 256U. Ask for Bulletin MU-203.

Wagner Electric Corp, 6400 Plymouth Ave, St. Louis 14, Mo.





120,000 Kva

THREE PHASE • CONTOUR DESIGN

Pennsylvania Power Transformer

Two 120,000 Kva Pennsylvania generating station transformers are connected to a 200,000 Kw generator of an Eastern utility. Their function is to step up the generated voltage of 19,800 volts to 145,000 volts for transmission around a metropolitan area. Each transformer arrived at the generating station in an upright position, completely assembled except for bushings and forced-cooling equipment. Transformer oil is cooled through four forced-oil to forced-air heat exchangers. The transformers were designed to operate during flood water levels up to four feet above transformer bases. Platforms provide accessibility to cabinets.

PENNSYLVANIA TRANSFORMER COMPANY

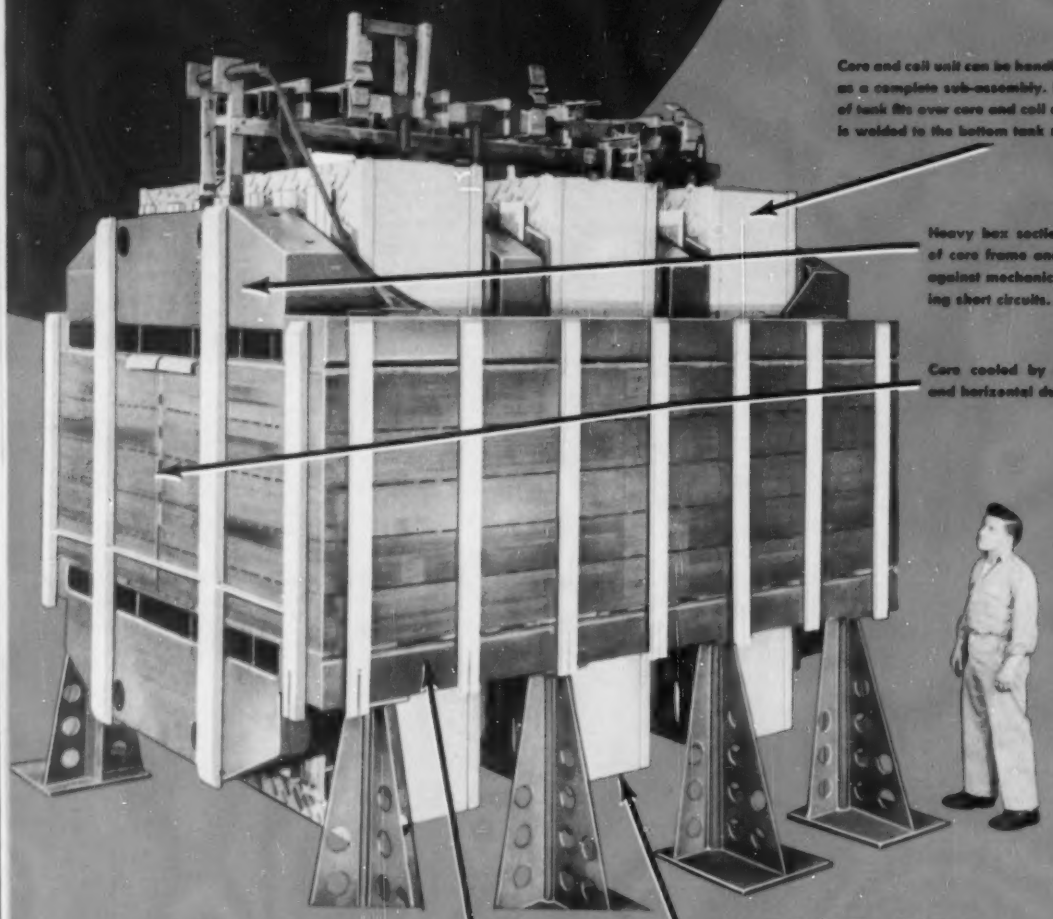
A McGraw Electric Company Division

CANONSBURG, PENNSYLVANIA • *Greater Pittsburgh District*

SEE NEXT PAGE FOR INSIDE STORY →

inside a 120,000 Kva Pennsylvania Power Transformer

• THREE PHASE
CONTOUR DESIGN



Core and coil unit can be handled separately as a complete sub-assembly. Upper section of tank fits over core and coil assembly and is welded to the bottom tank section.

Heavy box sections form part of core frame and clamp coils against mechanical forces during short circuits.

Core cooled by both vertical and horizontal ducts.

Core and coil assembly is designed to rest on bottom section of Contour Design tank.

Vertical cooling ducts in the coils permit a free flow of oil through the coils for most efficient cooling.

120,000 Kva, Three Phase, 60 Cycles, 55° C. Temperature Rise. Forced-oil with forced-air heat exchangers. High voltage: 145,000 Grd.Y volts. Low voltage: 19,800△ volts.

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PENNSYLVANIA • *Greater Pittsburgh District*

For exterior view of this transformer, see other side.

Beryllium Copper

Tempered beryllium copper wire with an ultimate tensile strength of 185,000 psi is said to be ductile enough to wrap around its own diameter. "Solvercote" can be formed into springs, wire rope and complex shapes without further heat treatment.

It has high strength and corrosion resistance, good electrical conductivity, is non-magnetic, has excellent fatigue qualities and comes finished with a silver plating which allows easy soldering and provides low contact resistance, according to the manufacturer.

Little Falls Alloys, Inc, 189 Caldwell Ave, Paterson, N. J.

Hot Line Tool

Pump action clamp stick can be used to install or remove hot line clamps on circuits over 5 kv.

Main feature of the "Shotgun" stick is that as the hook emerges, it flops up so that the point is visible to the lineman. Another feature is the method of hooding stop mechanisms so that linemen are less likely to pinch their hands, says the manufacturer.

Sticks (top) are available in 4, 6, 8 and 12 ft lengths. Extensions (bottom) are available in 4 and 6 ft lengths.

Bodendieck Tool Co, 325 E. Main St, Taylorville, Ill.

Luminaire

Semi-direct incandescent luminaire is said to bring all the advantages of natural lighting indoors. Paradome, as it is called, is a totally enclosed unit that controls all light rays emitted by either a 200 or 300-w lamp. Design of bottom concave Controlens has the same effect as tilting a lens away from a viewer. A fiber glass cover on the upper dome relieves contrast.

Holophane Co, Inc, 342 Madison Ave, New York 17, N. Y.

(*More New Products on page* 172)

the Remarkable

Anco LOCK NUT

- *cannot* be loosened by vibration
- only ONE nut necessary
- easier to install

Galvanized ANCO NUTS save time and money in installation . . . offer unusual strength and dependability. They're practically standard equipment for power line clamps, cross-arm braces, insulators . . . radio and TV transmission towers.

Only one nut is necessary for a permanent connection . . . the nut and lock are a single unit. Galvanized ANCO NUTS require no special tools . . . they're easily installed—or removed—by unskilled labor with any ordinary wrench. And galvanized ANCO NUTS provide top-notch performance . . . threads cannot be stripped . . . the locked nut cannot slip . . . vibration tends only to tighten an ANCO NUT.

Investigate the Galvanized ANCO NUT today . . . you'll find it's the best answer to your fastening problem.

ANCO LOCK NUTS

are made in all standard sizes, either black or galvanized, with standard U. S. or SAE thread. Also available in brass, bronze, aluminum, stainless steel, etc.

Write for samples, complete information, and prices.

automatic NUT CO., INC. Lebanon, Penna.

free

send for this catalog describing acker's new all-purpose digger

Send the coupon today for your copy of our new catalog showing the wide range of application as well as the many exclusive features that make the *Acker All-Purpose Digger* the most versatile and useful you can buy!

TWO MODELS TO CHOOSE FROM — Jeep mounting with compact, power take-off or skid-mounted with self contained power plant for truck mounting.

ACKER DRILL CO., Inc.
725 W. Lackawanna Avenue, Scranton, Penna.
Please send me free copy of Bulletin 40. EW.

Name_____ Title_____
Firm_____
Street_____
City_____ State_____

Smoke got in their Eyes

. . . but BEFORE the Fire!

Yes, the Men in Authority couldn't see the need—the *vital* need—for the *right* kind of fire protection. And fire struck, as always, when least expected—devastating fire that destroyed irreplaceable records, costly machines, buildings and supplies which will take months—months of no production—to rebuild and replace.

Statistics prove that too many fires result from failure to be ready for them—particularly in generators, transformers, switching and other electrical equipment.

Are *your* operations safe? A survey by Cardox will show you how CARDOX "Low Pressure Carbon Dioxide Systems"* can protect the danger spots in your plants against fire—eliminate fire extinguishment losses entirely. A few lines on your letterhead will bring full, eye-opening information.

*Covered by Patents Issued and Pending

CARDOX

ORIGINATOR OF **Low Pressure CO_2**

FIRE EXTINGUISHING SYSTEMS

CARDOX CORPORATION • BELL BUILDING • CHICAGO 1, ILLINOIS

Offices in Principal Cities

MORE NEW PRODUCTS

Smithcraft Lighting Div, Chelsea, Mass., has a **lighting fixture** designed for long, narrow areas.

G. C. Wilson & Co, 1950 Eighth Ave, Huntington, W. Va., has an electronic **interval timer** for use in cyclical operations of various machines.

Thomas & Betts Co, 36 Butler St, Elizabeth, N. J., has a line of self-insulated **connectors** for terminating armored cable and flexible conduit in sizes from ⅜ to 3 in.

Multi-Amp Corp, 10 Third St, Newark 7, N. J., will custom build **air-cooled transformers** and autotransformers in capacities from 5 va to 500 kva.

A. B. Chance Co, Centralia, Ill., has added Type "K" (fast) and Type "T" (slow) **fuse links** to its line of Mathews fuse links.

Keystone Mfg Co, Center Line, Mich., offers flangeless **panel adapters** for connecting wireway sections to panel boards and switchgear.

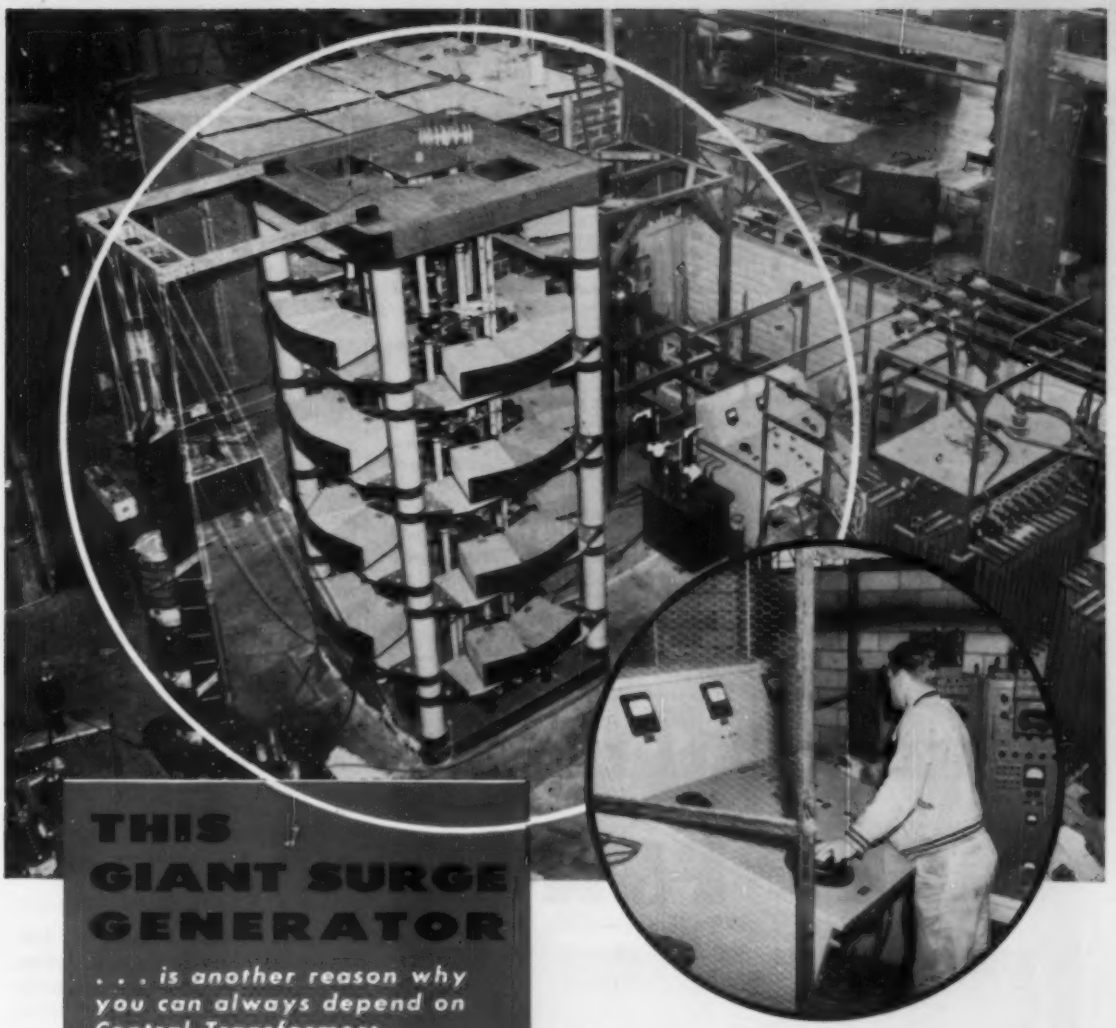
Sorensen & Co, 375 Fairfield Ave, Stamford, Conn., is making magnetic **voltage regulators** in two new sizes—250 and 500 va. Ask for Catalog MVR2.

U. S. Electrical Motors Inc, Box 2058 Terminal Annex, Los Angeles 54, Calif., is manufacturing a **submersible motor** for well pumping in ratings from ½ to 2 hp, 1-phase; and 1½ and 3 hp, 3-phase. Bulletin F-1870.

Sunshine Scientific Instrument, 1810 Grant Ave, Philadelphia 15, Pa., has a **coil turn counter** that measures the number of turns on coils wound on non-magnetic forms with an accuracy of 0.1%.

Permacel Tape Corp, New Brunswick, N. J., has a 1 mil polyester "Mylar" film, electrical **heat curing tape** (No. 253).

Engineering Devices Co, Box 7741, Chicago 80, Ill., offers a direct reading **motor calculator** that, for any relationship of speed vs torque, gives



THIS GIANT SURGE GENERATOR

. . . is another reason why you can always depend on Central Transformers

Every step in the manufacture of Central Transformers is carefully guarded to insure highest quality, finest performance. Specialists, responsible only to management, minutely inspect and test each operation. And the finest testing equipment is here to guarantee perfection.

For example, in the power test panel is this 1,600,000 volt surge generator equipped to impulse test transformers. It is a symbol of the precision and performance built into every Central Transformer. Hundreds of installations throughout the nation prove that Central Transformers meet the most rigid standards. We welcome your inquiries.

A type for every need . . . from the smallest to the largest

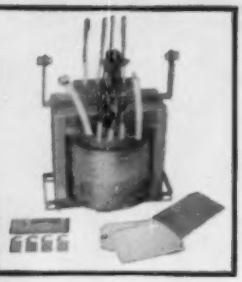
CTC NEMA **Central** Transformers

PINE BLUFF, ARKANSAS

Sales Offices in principal cities.

DESIGNERS AND MANUFACTURERS OF TRANSFORMERS ONLY

Easy to Install



Put them in any type transformer tank

1 Remove tapped lugs from top brackets of the assembly and weld them to tank wall. If old anchoring studs or lugs are already suitably located in tank wall, use them instead.

2 Position core and coil assembly over tank. Adjust expandable bottom brackets to meet sides of tank wall to assure accurate fit.

3 Lower assembly into tank and adjust top brackets to meet lugs in side wall. Anchor in place.

4 After cutting leads to required length, braze the terminals to the leads (all leads and terminals are identified).

ALLIS-CHALMERS CORE and COIL Replacement Assemblies

All Allis-Chalmers replacement units are packaged for your convenience. Immersed in oil in specially designed containers, they are protected against moisture and damage during transportation. Complete instructions enclosed with each unit.

Assemblies are available in ratings 25 kva and smaller, 15 kv and below, and conform strictly to NEMA standards. Use them in either conventional or protected types. Provisions for mounting low voltage breakers as well as a winding to operate signal light are standard. A-4633

Get original factory quality

▶ For information, call your nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 6186345A.

ALLIS-CHALMERS

PAGE chain link FENCE

America's First Wire Fence—since 1883

• When you think of hazards at your properties, think of PAGE. And when you think of protection against hazards, think again of PAGE. Whether you choose heavily galvanized Copper-Bearing Steel, corrosion-resisting Aluminum, or long-lasting Stainless Steel, PAGE Fence is quality controlled from raw metal to rugged fence erected on metal posts deep-set in concrete. Available are 8 basic styles, varied by heights, types of gates, top rails, and barbed wire strands for added security. Finally your PAGE Fence will be expertly erected by a reliable, technically trained firm. For important fence data and name of nearest PAGE firm—

Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia or San Francisco.

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

equivalent watts output and horsepower in decimal and common fractions along with percent efficiency for any value of watts input, in a single setting. Model FR7 covers a range from 1/2000 to ½ hp.

General Electric Co, 1 River Rd, Schenectady 5, N. Y., has:

Capacitors for high temperature applications above 150 C. They are rated 0.35 μf at 3,500 v dc. Power factor is 0.5 to 0.6% at 200 C.

Hollow-shaft vertical motors for pumping applications. They are made in ratings of 40 hp and up, in frame sizes 404 to 6330. All major parts are redesigned.

FHP motors designed for frequent start-stop service on machine tools. Ratings are ¼, ⅓, ½ and ¾ hp at speeds of 1725/1425 and 1140/950 rpm on 50/60 cps at voltages of 208/220/440, 220/380 and 550.

Low-speed synchronous inductor motors featuring instantaneous acceleration and deceleration, and instantaneous reversing. Torque ratings are 75 and 2 oz-in. at 25, 50 and 60 cps.

Automatic welding equipment for use with carbon dioxide shielding gas.

Mass spectrometer leak detector for use in production testing and inspection of products involving vacuum and pressure systems.

T. R. Finn & Co, Industrial Div, Hawthorne, N. J., has a line of **vibration mountings** for medium and heavy weight machinery. Load capacities range from 500 to 2,500 lb per mounting.

Square D Co, 4041 N. Richards St, Milwaukee 12, Wisc., offers a reverse action **pump control switch** for applications requiring protection on loss of pressure or to initiate operations on rising pressure.

W. S. Shamban & Co, 11617 W. Jefferson Blvd, Culver City, Calif., has **Teflon tape** (KELON-T) for electrical applications in widths up to 24 in. and thicknesses from 0.005 to 0.125 in.

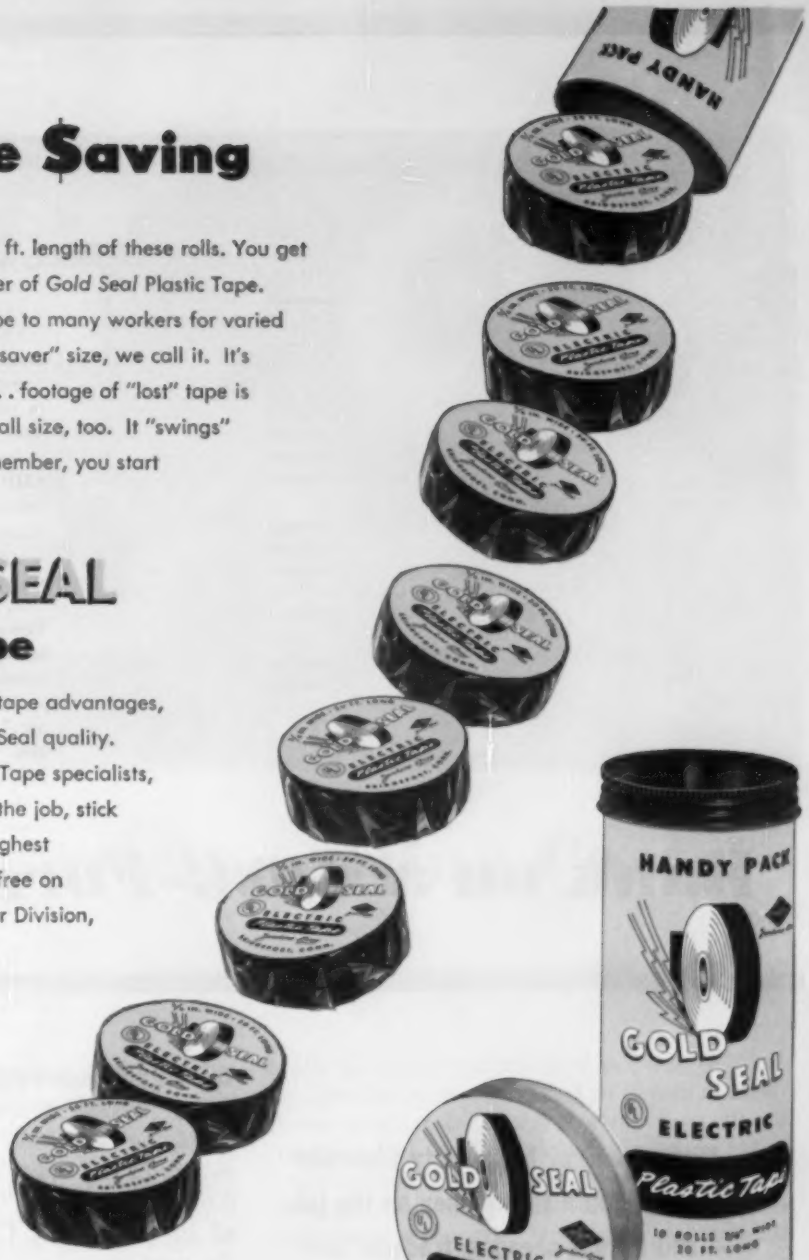
Irvington Div, Minnesota Mining & Mfg Co, 6 Argyle Terrace, Irvington 11, N. J., offers a **silicone resin treated tape,** known as SG-300, which is said to possess high dielectric strength, and rigidity.

$ensible $aving

is the smart reason for the 20 ft. length of these rolls. You get this size in the 10-roll container of *Gold Seal* Plastic Tape. For companies that supply tape to many workers for varied jobs, it's the best buy. "Tape-saver" size, we call it. It's enough for the average job . . . footage of "lost" tape is kept low. Workers like the small size, too. It "swings" easy in tight places. And remember, you start saving the minute you say

GOLD SEAL
plastic tape

It gives you the many plastic tape advantages, with the plus of proved Gold Seal quality. With the warranty of Jenkins Tape specialists, you can be sure it will speed the job, stick right, and stand up under toughest conditions. Try it . . . sample free on request. Jenkins Bros., Rubber Division, 100 Park Ave., New York 17.



Gold Seal Plastic Tape — single 60 ft. rolls in round metal cans and Handy Pack of ten 20 ft. rolls.

JENKINS

Gold Seal Tape

FRICTION • RUBBER • PLASTIC

Single rolls and 10-roll containers. Also Diamond Seal Friction and Rubber Tapes made to ASTM Specifications. Products of Jenkins Bros. — makers of famous Jenkins Valves.

Bank on a *Task-Force* Truck

With pickup or heavy-duty Chevrolet model, you'll save money on the job —and be way ahead at trade-in time!

CHEVROLET

You save with modern high-compression power—In the ½-ton model, a new Thriftmaster engine is supplying the power punch. It's a new Loadmaster in the heavy-duty model (or a big 140-h.p. Jobmaster, an extra-cost option). With all of these great Chevrolet engines you get the most out of a gallon of gas. You accelerate fast, level the hills that could cut valuable time from your schedules. And even in cold weather you start more quickly with Chevrolet's hefty 12-volt electrical system. That's a big advantage in itself—a husky reserve of electrical power when you need it!

NEW CHEVROLET

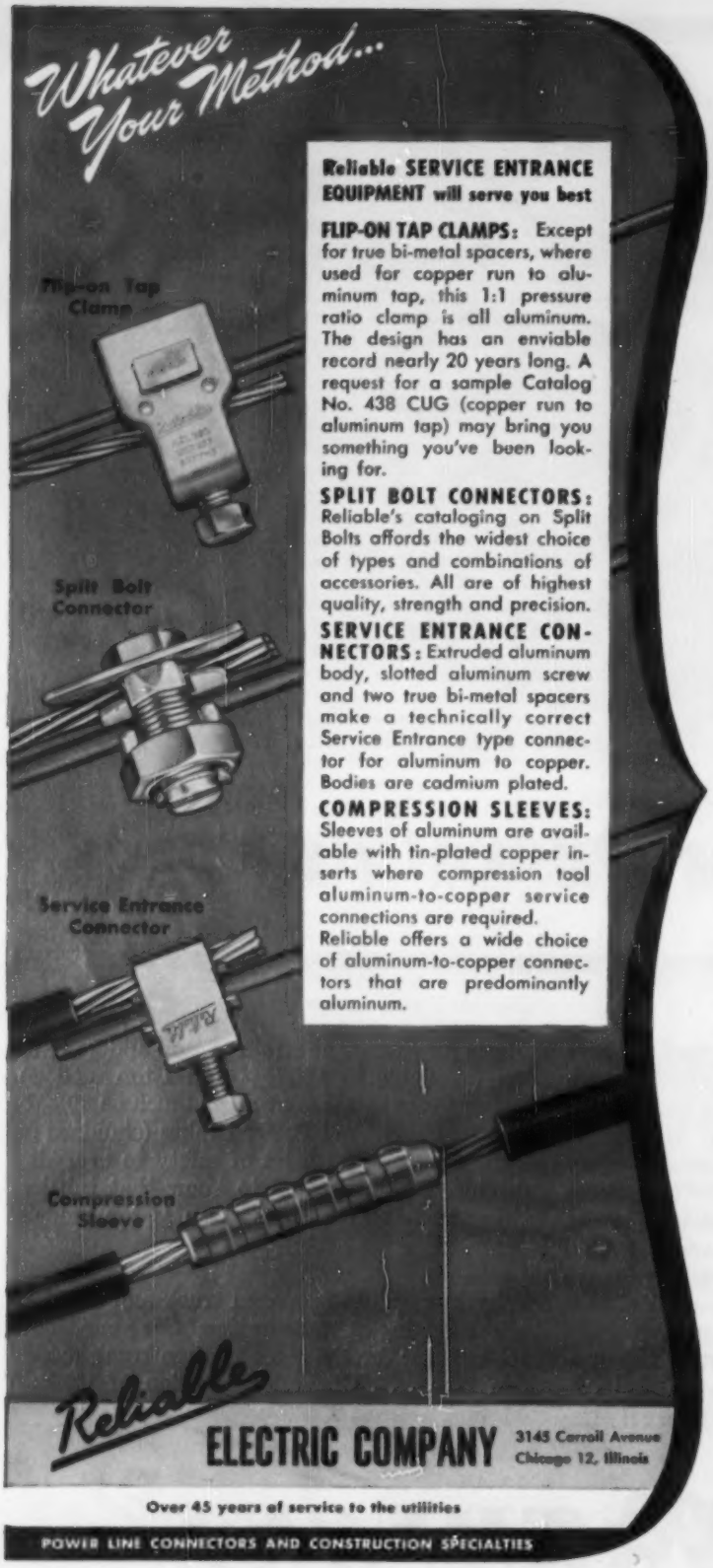
to Cut Your Operating Costs!

You save with the most modern truck features your industry has ever seen—New standard-width frames—more rigid with completely parallel side members. Panoramic windshield, High-Level ventilation, softer seats and new concealed Safety Steps—they're features that make Task-Force trucks extra easy to live with. Driving's less of a chore. And with driver efficiency up, you'll stay even with your tightest schedules, save money in the long run!

And you save with these extra-cost power helpers—You're bound to save money when you can maintain peak efficiency! You can't beat Hydra-Matic for easing the strain of stop-and-go hauling (available in ½-, ¾- and 1-ton models). Power Steering takes away as much as 80% of turning effort. And Power Brakes (standard on 2-ton models) add a lot of safety to everyday driving. You'll be glad to know that tubeless tires come at no extra cost on ½-ton models.

Why buy an old-fashioned truck and stand to take a licking at trade-in time? See your Chevrolet dealer for the most modern truck money can buy. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

Task-Force TRUCKS


Whatever Your Method...
Reliable SERVICE ENTRANCE EQUIPMENT will serve you best
FLIP-ON TAP CLAMPS: Except for true bi-metal spacers, where used for copper run to aluminum tap, this 1:1 pressure ratio clamp is all aluminum. The design has an enviable record nearly 20 years long. A request for a sample Catalog No. 438 CUG (copper run to aluminum tap) may bring you something you've been looking for.
SPLIT BOLT CONNECTORS: Reliable's cataloging on Split Bolts affords the widest choice of types and combinations of accessories. All are of highest quality, strength and precision.
SERVICE ENTRANCE CONNECTORS: Extruded aluminum body, slotted aluminum screw and two true bi-metal spacers make a technically correct Service Entrance type connector for aluminum to copper. Bodies are cadmium plated.
COMPRESSION SLEEVES: Sleeves of aluminum are available with tin-plated copper inserts where compression tool aluminum-to-copper service connections are required.
Reliable offers a wide choice of aluminum-to-copper connectors that are predominantly aluminum.
Flip-on Tap Clamp
Split Bolt Connector
Service Entrance Connector
Compression Sleeve
Reliable
ELECTRIC COMPANY
3145 Carroll Avenue
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Over 45 years of service to the utilities
POWER LINE CONNECTORS AND CONSTRUCTION SPECIALTIES

CATALOGS • BULLETINS

● **LIGHT CONTROL:** Bulletin L155P, 12 pages, describes packaged light control equipment for commercial uses. Applications, dimensions and wiring diagrams are included. Superior Electric Co, Bristol, Conn.

● **MOTORS:** Booklet 1856, 12 pages, describes and illustrates the design and manufacture of Type H Uniclosed motors. U. S. Electrical Motors Inc, Box 2058, Los Angeles 54, Calif.

● **LAMP TRANSFORMERS:** Bulletin No, MV-211, 4 pages, gives characteristics, performance and specifications of constant wattage mercury vapor lamp transformers for indoor use. Sola Electric Co, 4633 W. 16th St, Chicago 50, Ill.

● **PRIVATE TELEPHONES:** Use of an internal, company-owned telephone system in controlling and coordinating production is described in Bulletin 1764, 4 pages. Automatic Electric Sales Corp, 1033 W. Van Buren St, Chicago 7, Ill.

● **LAMINATED INSULATION:** Catalog D-55 contains descriptions of fabrication and application of over 50 fillers and resins combined by lamination and polymerization into a dense plastic. Forms available, and electrical, chemical and mechanical characteristics are included. Continental-Diamond Fibre Co, Newark, Del.

● **GE BULLETINS:** Following are available from General Electric Co, 1 River Rd, Schenectady 5, N. Y.:

ATOMIC POWER EQUIPMENT: Bulletin GEA-6014 contains descriptions and illustrations of equipment available for use in nuclear reactor and nuclear reactor laboratory systems. It covers complete research reactor systems, remote handling equipment, an electromagnetic pump and coolant system components.

MOTOR CONTROL: A 12-page bulletin, GEA-6331, outlines features of Limit-amp high-voltage motor control for coordinate control of squirrel-cage, synchronous, wound-rotor and multi-speed motors. Ratings and dimensions are given.

FUSES: Current-limiting fuses rated 250 and 600 v in sizes from 6 to 200 amp are described in Bulletin GEA-6319. Specifications, characteristic curves, tables of maximum ratings for conductors, melting times, and minimum back-up are included along with dimensions.

ADJUSTABLE-SPEED DRIVE: Bulletin GEA-6234 covers the general-purpose, full-wave, Thy-mo-trol adjustable-speed drive for motors from ½ to 3 hp.

REPAINTING TRANSFORMERS: An 8-page bulletin, GET-677F discusses proper painting methods for longer life, preparation of paint and number of coats required for repainting transformers in the field. It includes a discussion on repainting subway transformers.

● **AERIAL EQUIPMENT:** A 4-page folder describes and illustrates truck mounted elevating equipment for overhead line work. McCabe-Powers Auto Body Co, 5900 N. Broadway, St. Louis 15, Mo.

● **WESTINGHOUSE BULLETINS:** Following are available from Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa:

INSULATIONS: A 12-page booklet B-6506, explains advantages of Thermalastic insulation in extending the life of rotating electrical equipment. It also describes how Thermalastic was developed.

X-RAY: A 250-kv constant potential x-ray for studying internal structure of opaque material is described and illustrated in Booklet XB 404-700.

● **SMALL MOTOR SWITCHES:** A complete line of toggle, rotary and pushbutton switches for small motors is described in

a 13-page catalog (EC-79). Illustrations are included along with ratings and dimensions. Cutler-Hammer, Inc, 235 N. 12th St, Milwaukee, Wisc.

● **INDUSTRIAL HEATING:** Bulletin No. 555, 19 pages, presents the basic concepts of industrial heat processing and heat control. Formulas used in calculating heat and oven requirements are included. Michigan Oven Co, 415 Brainard, Detroit 1, Mich.

● **RECORDER:** A 2-page data sheet (E-ND46(3)) describes and illustrates the "Speedomax" two pen recorder for the measurement of any two variables such as stress and strain, megawatts and megavars or width and thickness. Leeds & Northrup Co, 3934 Stenton Ave, Philadelphia, 44, Pa.

● **MAGNETIC BRAKES:** Bulletin 226-D covers magnetic brakes and clutches. It contains selection data including torque requirements, service factors, descriptions, features and dimensions. Stearns Magnetic Inc, Milwaukee 46, Wisc.

● **DEHYDRATION EQUIPMENT:** Packaged dehydration units for drying air or other gases in industrial or laboratory installations are described in Bulletin No. 16.0.081. Operating and construction details, and ratings and dimensions are included. J. F. Pritchard & Co, 210 W. 10th St, Kansas City, Mo.

● **MOTORS:** An 8-page catalog, SDA-155, describes a line of ½ to 30 hp, single phase, polyphase and dc motors. It gives information on motor selection, enclosures, mountings, modifications, and data on fractional and integral hp frame sizes. Peerless Electric Co, Motor Div, W. Market St, Warren, Ohio.

● **SPEED REDUCERS:** Engineering Manual LP No. 3 gives complete information on a line of speed reducers with capacities from ranging from fractional hp to 150 hp. Application data, ratings and dimensions are included. Foote Bros. Gear & Machine Corp, 4545 S. Western Blvd, Chicago, Ill.

● **CONTROL SYSTEMS:** Bulletin No. S-10 describes how the manufacturer can assist in arriving at the right application of an automatic control system. Case histories are presented with descriptions of various controls. Automatic Temperature Control Co, Inc, 5200 Pulaski Ave, Philadelphia 44, Pa.

● **ELECTRO-MAGNETS:** Construction, applications and ratings of electro-magnets are given in publication EC-88. Illustrations show magnets in various metal handling jobs. Cutler-Hammer, Inc, N. 12th St, Milwaukee, Wis.

● **PORTABLE CORDS:** A 7-page catalog gives applications and ratings of "cured-in-lead" portable cords rated up to 600 v. A description of the manufacturing process is included. Simplex Wire & Cable Co, 79 Sidney St, Cambridge 39, Mass.

● **MAGNETIC BRAKES:** Bulletin BK-4002 describes magnetic disc brakes for motors from 1/6 to 50 hp. Uses, dimensions, wiring diagrams and application formulae are also given. Dings Brakes Inc, 4740 W. Electric Ave, Milwaukee, Wisc.

● **SWITCHES:** A 4-page bulletin describes features of new Type "G" service switches in ratings from 30 to 200 amp. Murray Mfg. Corp, 1250 Atlantic Ave, Brooklyn 16, N. Y.

● **WIRE & CABLE:** Silicone rubber-insulated high-temperature wires and cables are described in an 11-page booklet (Pub. No. 19-594). Included are tables listing physical properties and graphs comparing silicone cables to organic rubber-insulated cables. General Electric Co, Construction Materials Div, Bridgeport 2, Conn.

Whichever Way You Hang Your Drops...
Service Wedge Clamp
Straight-thru Deadend with Flexible Bail
Compression Deadend with Stainless Bail
Tie Straps

Reliable HAS THE RIGHT EQUIPMENT

ALUMINUM SERVICE WEDGE CLAMP: Available for either aluminum or copper with stainless steel bails or flexible bronze bails. Does not require feeding through clamp, may be attached to bare neutral of formed 3-wire drop at any point in span. Saves drop wire by permitting cut to exact length. Made in two sizes covering conductor range from 1/0 ACSR to No. 6 solid.

STRAIGHT-THRU AUTOMATIC DEADENDS: For copper and for aluminum with any type bail or clevis. Easily hung on hooks, spools or knobs. Permits easy adjustment of slack. Develops approximately full strength of conductor.

ALUMINUM COMPRESSION DEADEND: for aluminum only. Internally impregnated with a dispersion of fine, sharp silicon carbide particles to insure holding power. Provided with stainless steel bail having one leg detachable for use with spools or knobs. For service installations where compression tool joint is preferred. A compression deadend for banking transformers.

ALUMINUM TIE STRAPS: A simple method for tieing two insulated lines to the supporting bare neutral of formed 3-wire drop. High efficiency at low cost. Reliable equipment answers the problems in hanging drops for there is a unit to do efficiently any job in a manner that conforms to your practice.

Reliable ELECTRIC COMPANY 3145 Carroll Avenue Chicago 12, Illinois

Over 45 years of service to the utilities

POWER LINE CONNECTORS AND CONSTRUCTION SPECIALTIES

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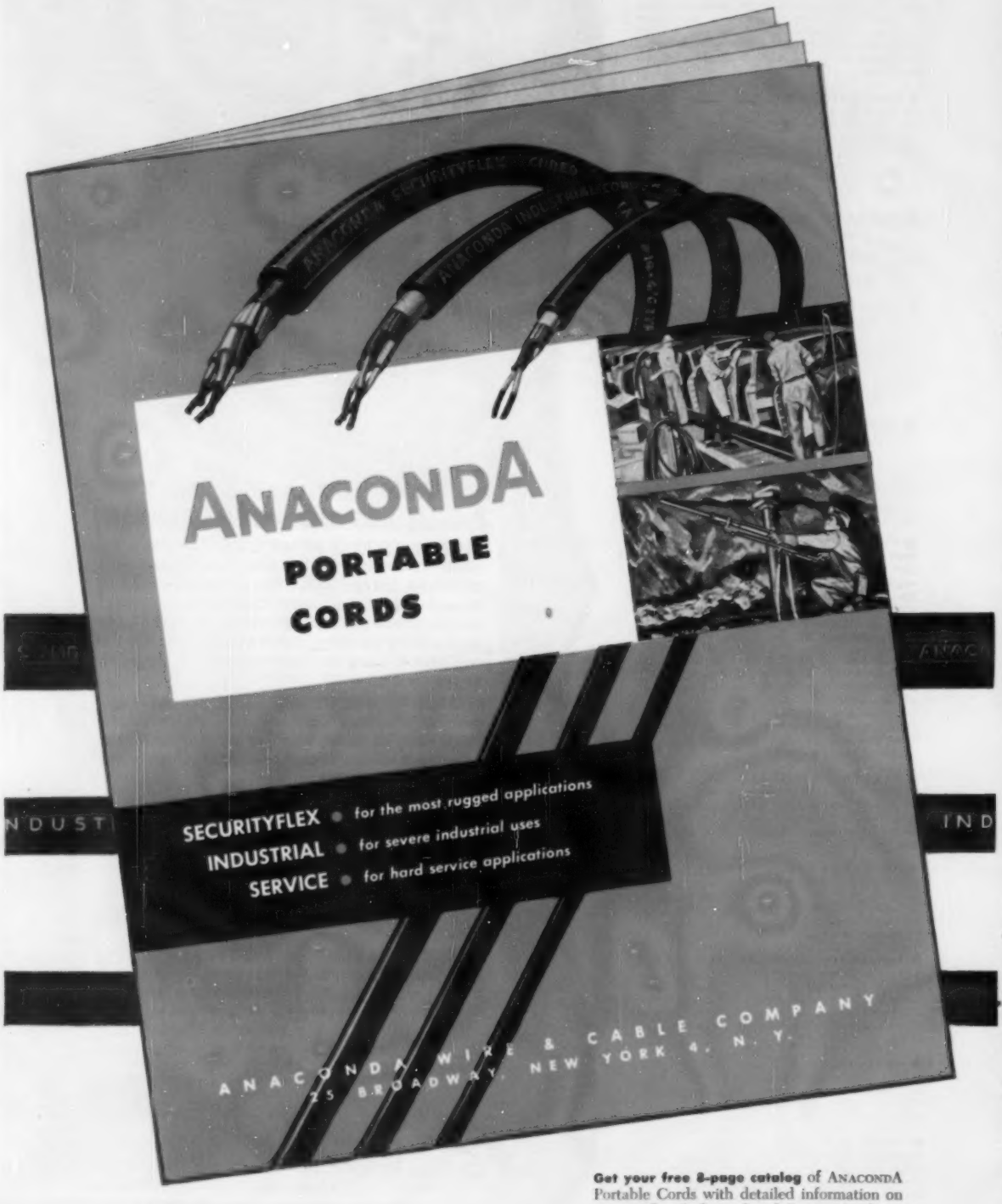
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PORTABLE
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SECURITYFLEX • for the most rugged applications
INDUSTRIAL • for severe industrial uses
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Get your free 8-page catalog of ANACONDA Portable Cords with detailed information on Securityflex, Industrial and Service Cords . . . plus a handy applications reference chart and properties table.

complete line of HEAVY-DUTY cords helps you

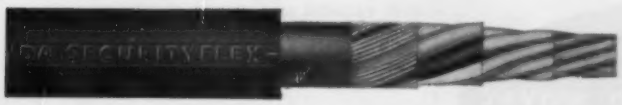
PICK THE RIGHT CORD FOR YOUR JOB!

Now—Anaconda introduces new portable cords with rugged construction . . . peak performance . . . and top flexibility for 3 types of service!

Severe applications . . . Hard usage . . . Standard service — Anaconda brings you 3 new engineered cords designed with the exact physical properties needed for each type of job—strength, flexibility and resistance to wear!

Select the cord *best suited* to your needs—based on good engineering and sound economics.

Whichever cord you choose, the Anaconda trademark is your assurance of *premium performance.*



SECURITYFLEX—Underwriters' approved Types SO and SJO.

SECURITYFLEX* CORDS for severest conditions. Toughest, sturdiest cords made . . . used where strength and wear-resistance are a "must." Neoprene jacket *mold-cured in lead* gives top crush, abrasion- and oil-resistance. Cords pay for themselves with long life under severest conditions—in mines, railroads, docks, and in heavy industrial use. Look for the molded-in name, "Securityflex!"

INDUSTRIAL—Underwriters' approved Types SO and SJO.

INDUSTRIAL CORDS for heavy industrial conditions and *maximum flexibility.* Lower in cost. Specially designed for use in heavy industry—where cords are in continuous operation and must be tough, flexible, oil-resistant. Tough neoprene jacket. Many industrials stock this one cord for use in virtually all applications . . . reducing inventory problems and costs. Look for the Anaconda marking on jacket.

SERVICE—Underwriters' approved Types S and SJ.

SERVICE CORDS for regular duty. Lowest in cost . . . yet have many features found only in higher priced cords of other makes. Special rubber jacket withstands abuse and moisture. Outstanding for appliances, office machines, portable tools—where flexibility and long life are needed.

*Reg. U. S. Pat. Off.

see the man from . . .

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PORTABLE CORDS

FREE "PORTABLE CORDS" BULLETIN

Anaconda Wire & Cable Company,
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Gentlemen: Please send me your new free "Portable Cords" bulletin, DM-5538.

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COMPANY .....
ADDRESS .....
CITY, ZONE, STATE .....

BEAUTY AND THE BEST

Once upon a time individual light controls were costly . . . and not very handsome. Then American Electric simplified the design. Unnecessary wires and tubes were eliminated while load rating increased to 1000 watts. Polyethylene cover is non-breakable, weatherproof, and snaps into place without screws or clamps. Specify this beauty and get the best . . . for 20% less than you would normally expect to pay.

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LIGHTING CONTROLS

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a new, superior system of CABLE and TUBING race ways

GLOBE'S CABLE WAY

A completely engineered system of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests. The universal splice plate joins all parts through the side channels only. All curved fittings are joined at the end of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.

Comes in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Cable way can be cut to length at any point—insides and bottom always smooth—all sections punched for easy installation—perfect fit at all times. Neat, clean and uniform in appearance.

Write for new complete catalog.
Distributors in all principal cities.
Contact the Grip-Strut distributor under "Grating" in the classified telephone directory.

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BOOKS

Railroad Problems

Electric Railway Engineering. By T. Ferguson. Published by MacDonald & Evans, Ltd., 8 John St, Bedford Row, W.C. 1, London, Eng. 443 pages, 132 illustrations. Price 57s. 6d.

Engineers handling electric railroad problems often are assigned during their lifetimes one or two projects beyond their knowledge and experience. Though they may have mastered the fundamentals of traction and motor control, their answers to these rare but important problems often are costly, inferior, and troublesome. This book was created to guide these engineers in their hours of travail.

The author draws liberally from his 50-yr experience in electric railway engineering. He assumes the reader is no novice, and he explains simply such complex subjects as: How to determine the total traction-effort-with-respect-to-speed characteristic required for suburban services or main-line locomotives which will satisfy the traffic and physical conditions, and how to convert this into suitable individual motor characteristics acceptable to motor designers; how to determine the number, positions, and ratings of substations; how to figure the effect of high-voltage transmission and transformers on voltage regulation of mercury-rectifier substations, and the ultimate voltage regulation at the trains.

Utility engineers who handle railroad accounts may find parts of this book valuable as a source of information for advising railroads on specialized electrical problems.

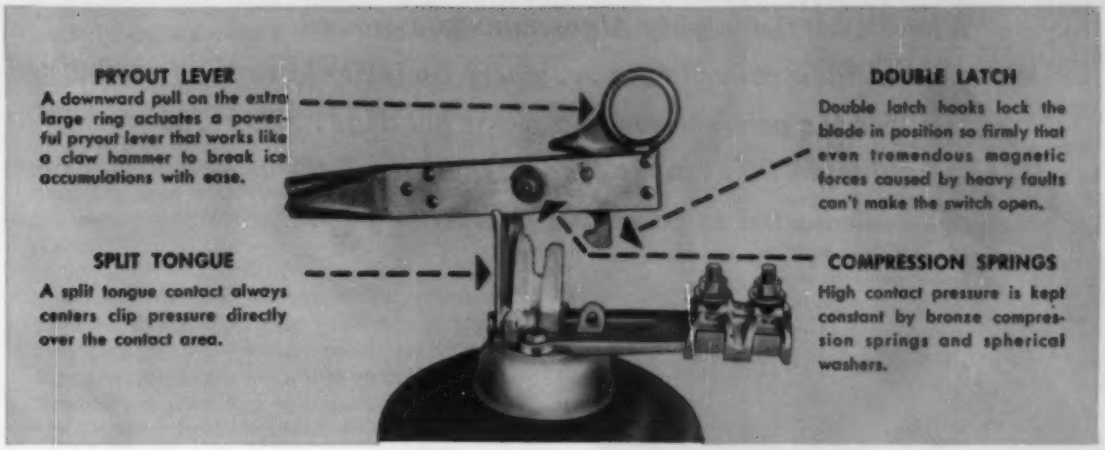
Data on Refrigeration and Air Conditioning

Air Conditioning—Refrigeration Data Book, Applications Volume. 5th Edition. Harold M. Hendrickson, Editor-in Chief. Published by American Society of Refrigerating Engineers, 234 Fifth Ave, New York 1, N. Y. 984 pages, illustrated. Price $7.50.

This 5th edition contains 61 chapters, written by 89 experts, each a specialist in his field. There are three newly-added chapters: Precooling, Fishing Boats, and Passenger Automobiles. Chapters on Fisheries' Products, Breweries, Refrigerated Warehouse Design, Ship's Stores, and Cold Treatment of Metals have been entirely rewritten. Most of the remaining chapters have been revised.

Volume includes design information, formulas, tables, diagrams, and sample engineering calculations in factual handbook-style presentation. Classified section lists manufacturers of components and assembled units of air conditioning and refrigerating equipment.

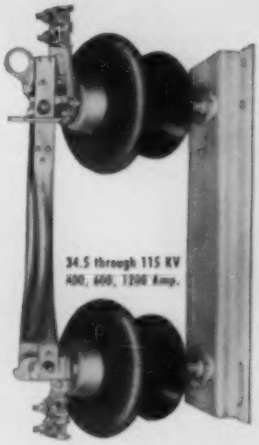
It should be useful to electric utility commercial and industrial sales engineers, consulting engineers, and building and plant maintenance supervisors.


PRYOUT LEVER
A downward pull on the extra large ring actuates a powerful pryout lever that works like a claw hammer to break ice accumulations with ease.
SPLIT TONGUE
A split tongue contact always centers clip pressure directly over the contact area.
DOUBLE LATCH
Double latch hooks lock the blade in position so firmly that even tremendous magnetic forces caused by heavy faults can't make the switch open.
COMPRESSION SPRINGS
High contact pressure is kept constant by bronze compression springs and spherical washers.

These Hook Stick Switches last longer

because they can take more punishment...

Linemen can always close Chance BT Switches easily...from any angle...contact blades have extreme rigidity and are designed to withstand heavy side thrusts.



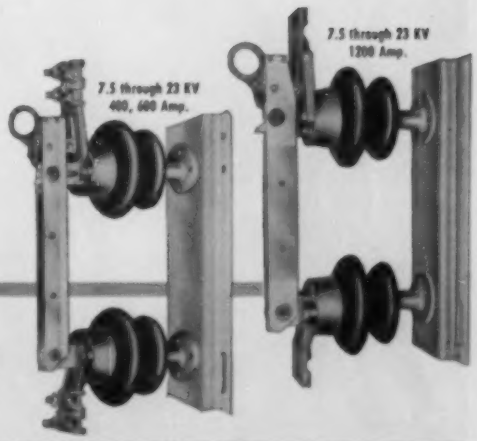
Chance BT Disconnect Switches

Talk about tough, rugged disconnect switches... you should see *Chance BT Hook Stick Switches* in operation.

You'll find unequalled strength in the double-trussed tubular blade on models rated from 34.5 through 115 KV... the heavy flat parallel bus bars that serve as blades on the 23 KV and smaller 1200 ampere switches... and the flanged reinforced bus bar blades on the 400 and 600 ampere switches.

In all models of this sturdy switch, which can take anything the "slambangingest" lineman can dish out, contact blades are held rigidly in place—making quick sure contacts possible at all times.

Chance BT Switches can really take it... giving you years of extra service... try 'em, you'll see. If you'd like to have more information first, why not see your Chance representative or write for catalog material and test data?



ABC Industries

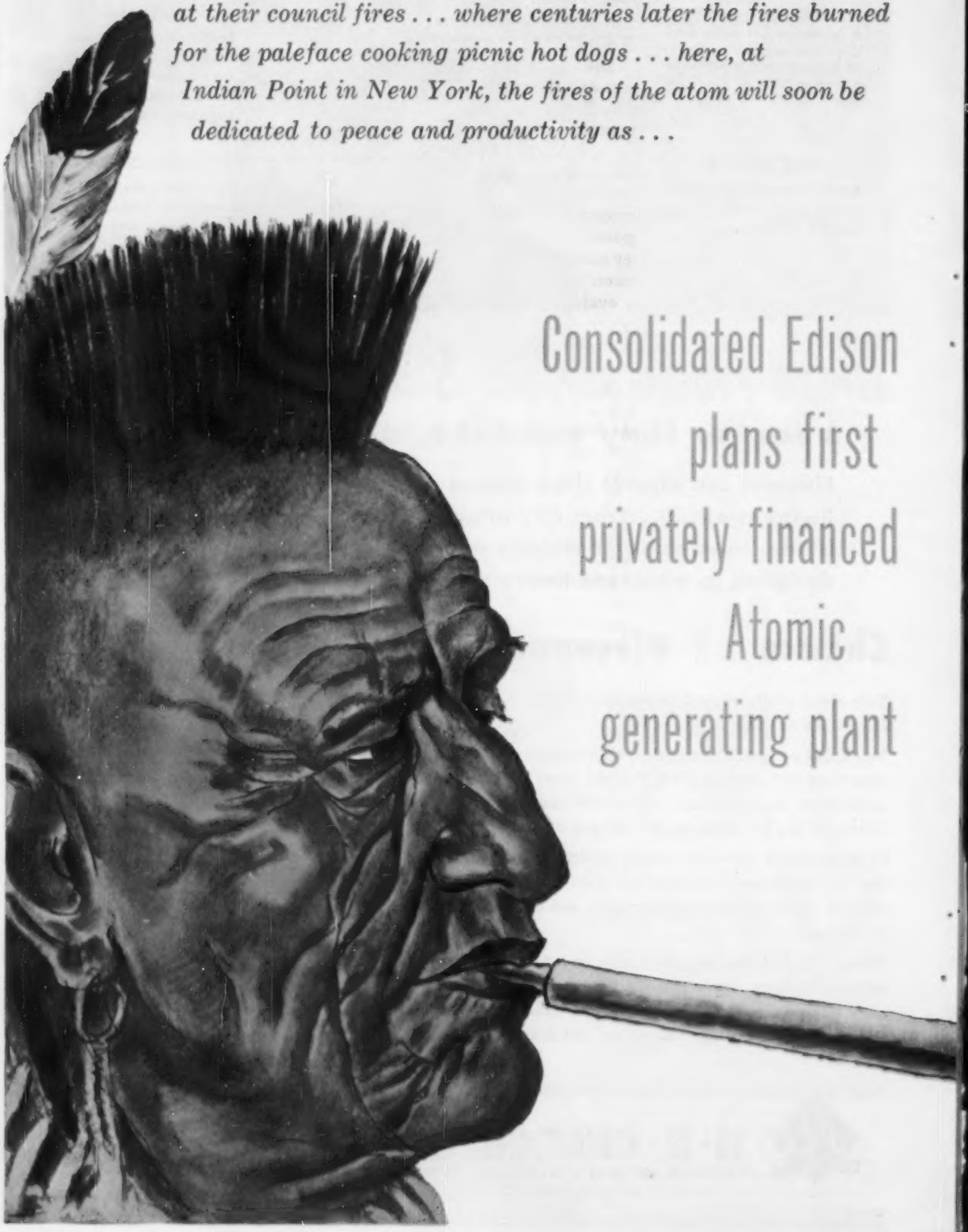
A·B·CHANCE CO.

CENTRALIA, MISSOURI • San Francisco, California

(In Canada: A. B. Chance Company of Canada, Ltd., Toronto 13)

CS55-12

Where once the mighty Algonquins pow-wowed at their council fires . . . where centuries later the fires burned for the paleface cooking picnic hot dogs . . . here, at Indian Point in New York, the fires of the atom will soon be dedicated to peace and productivity as . . .



Consolidated Edison plans first privately financed Atomic generating plant

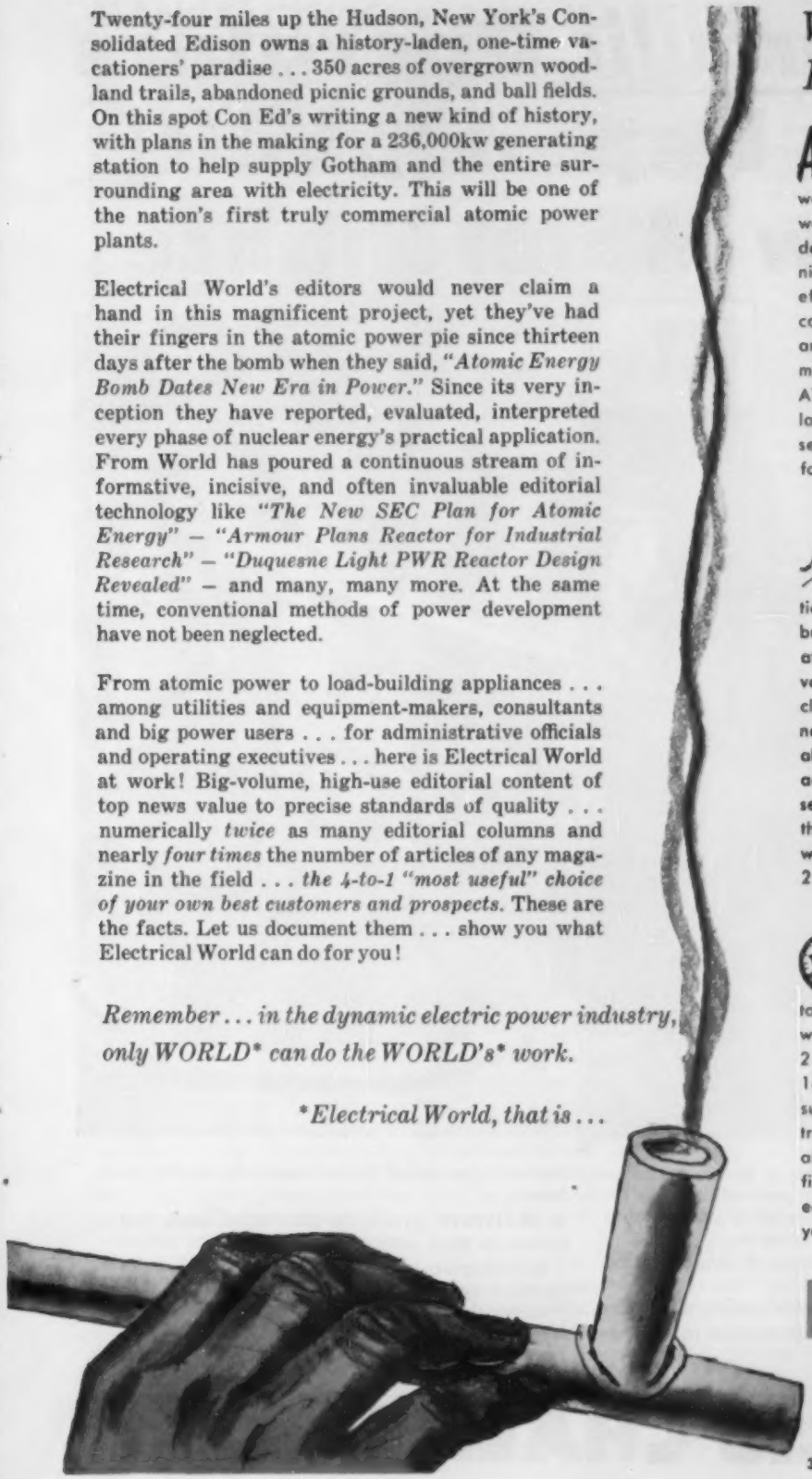
Twenty-four miles up the Hudson, New York's Consolidated Edison owns a history-laden, one-time vacationers' paradise . . . 350 acres of overgrown woodland trails, abandoned picnic grounds, and ball fields. On this spot Con Ed's writing a new kind of history, with plans in the making for a 236,000kw generating station to help supply Gotham and the entire surrounding area with electricity. This will be one of the nation's first truly commercial atomic power plants.

Electrical World's editors would never claim a hand in this magnificent project, yet they've had their fingers in the atomic power pie since thirteen days after the bomb when they said, *"Atomic Energy Bomb Dates New Era in Power."* Since its very inception they have reported, evaluated, interpreted every phase of nuclear energy's practical application. From World has poured a continuous stream of informative, incisive, and often invaluable editorial technology like *"The New SEC Plan for Atomic Energy"* – *"Armour Plans Reactor for Industrial Research"* – *"Duquesne Light PWR Reactor Design Revealed"* – and many, many more. At the same time, conventional methods of power development have not been neglected.

From atomic power to load-building appliances . . . among utilities and equipment-makers, consultants and big power users . . . for administrative officials and operating executives . . . here is Electrical World at work! Big-volume, high-use editorial content of top news value to precise standards of quality . . . numerically *twice* as many editorial columns and nearly *four times* the number of articles of any magazine in the field . . . *the 4-to-1 "most useful" choice of your own best customers and prospects.* These are the facts. Let us document them . . . show you what Electrical World can do for you!

Remember . . . in the dynamic electric power industry, only WORLD can do the WORLD's* work.*

**Electrical World, that is . . .*



What in the Electrical World?

A.W. . . . . . as reported by EW in the June 27 issue leaves much to be desired in the way of progress after years of work. Why has adequate wiring developed into a full-grown juvenile delinquent despite all parental effort to bring it into line? Now, corrective action must be taken — and fast! What's being done is mirrored in EW's report on the AW activities of 76 of the nation's largest utilities. We'll be glad to send you the 12-page reprint; ask for "AW Report."

"REACH"-ERSHIP and Readership—a recent EW survey covering a substantial sample (44%) of readers of business and technical publications at a large utility. The study develops some interesting figures, including a preference for EW of nearly 10 to 1 — your proof of an alert, interested audience for your advertising. Your local EW representative will be glad to show you this example of real preference where it pays off—among EW's 25,000 all-paid subscribers.

METER MATTER . . . Current headache to many utilities are the millions of meters too new to scrap, too old to cope with residential loads approaching 2 kw. If you missed the May 30th 16-page report on EW's 66-utility survey of the meter and service entrance problem, reprints are available on the whole story as obtained first-hand from utility operating executives. Just drop us a line for your copy . . . no charge, of course.

Electrical World

ABC ABP

A McGraw-Hill Publication
330 West 42nd Street, New York 36, N. Y.

Pneu-Draulic Operators Prove Dependability ...Low Maintenance

The *Pneu-Draulic* operator is in use on Allis-Chalmers breakers in many parts of the country. Its planned simplicity and reliability have led to quick and widespread acceptance.

Here are a few advantages of this operating mechanism:

★ **Dust** eliminated by virtual sealing of system.

★ **Corrosion** eliminated because oil in the system contains one of the best corrosion inhibitors known.

★ **Moisture** problems eliminated, since the system is filled with oil.

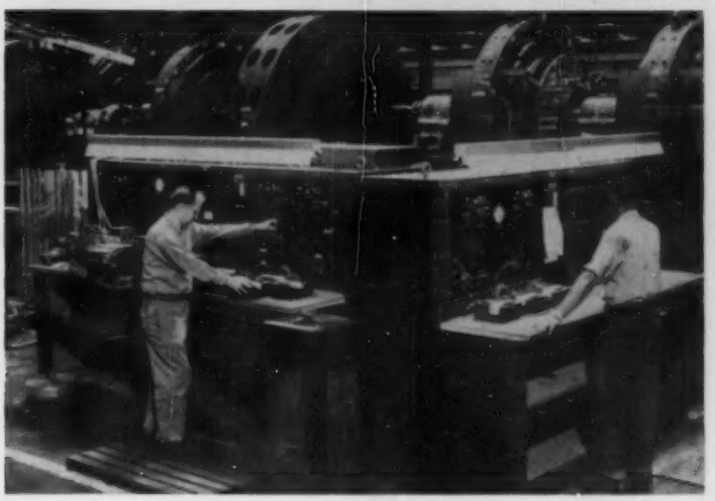
Get complete information on the *Pneu-Draulic* operator and the Allis-Chalmers breaker. Call your nearby A-C office, or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 71B7942.

A-4524

Pneu-Draulic is an Allis-Chalmers trademark.

ALLIS-CHALMERS

MANUFACTURERS AND MARKETS



GE Opens Rotating Machine Test Center

A new center for testing rotating electrical equipment rated up to 70 Mva, was formally dedicated by General Electric Co at Schenectady, N. Y., on June 21. The $1 million center is part of the GE Large Motor & Generator Department's $8 million expansion program.

Main function of the center will be pre-shipment testing of large hydraulic and steam-turbine generators, synchronous condensers, and both ac and dc motors and generators. GE states that the facilities will enable ac machines to be tested by the zero-power factor-method under conditions more severe than are found in the field.

Heart of the test room is a synchronous generator with a base rating of 60 Mva, driven by a variable speed dc motor to provide current of variable frequency. Also in this room are switchgear, exciter sets and a motor-generator set which supplies dc current.

The center occupies an area of 4,188 sq ft. Instrument stands on the factory floor proper occupy about 1,425 sq ft. Shown above are instrument panels on the floor outside the test area. In the background is an 11,000-kw motor-generator set being tested.

Atomic Scientists Tell of Industry's Need

Development and production of effective fuels and components are vital factors in hastening the advent of large-scale atomic power projects, according to recent statements by Dr Henry H. Hausner and Stanly B. Roboff of Sylvania Electric Products Co's Atomic Energy Division.

Hausner and Roboff said that it is estimated that U. S. industry will spend $300 million during the next four years on atomic research alone. They added that the highest percentage will go for research on atomic materials.

It was pointed out by Hausner, who is manager of atomic engineering of Sylvania's Atomic Energy Division, that the manufacture of reactor components alone may exceed $700 million by 1963 and that the atomic energy industry will need some 30,000 to 40,000 scientists and engineers by that time. This is said to be more than twice the number now employed in the industry.

Roboff, who is manager of industrial coordination of the Atomic Energy Division, pointed out that under the new rules approved by the AEC, citizens or firms of this country may now secure "access permits" to "confidential" data if they have an "L" clearance and can show "potential use or application" of the information in their business.

Kaiser Engineers Starts Nuclear Reactor Designs

Design of an engineering test reactor has been started by the Atomic Energy Division of Kaiser Engineers. This announcement was made by George Havas, vice president and general manager of Kaiser Engineers Division of Henry J. Kaiser Co. The company received a contract award by the Idaho Operations office of the Atomic Energy Commission designating the company as architect-engineer for the project.

This nuclear reactor will be employed in testing in high radiation fields, materials related to the development of cores, fuel assemblies, and other components of reactor projects. The new reactor would cost an estimated $10 million to $15 million if constructed by the Government at the National Reactor Testing Station in Idaho, according to the Kaiser Co.

Budd Uses Cash-Stock to Acquire C-D-F Assets

Continental-Diamond Fibre Division of The Budd Company, Inc. became a wholly owned subsidiary of The Budd Co, Philadelphia, on July 1 when the latter assumed ownership and management of principal assets of the Continental-Diamond Fibre Co.

Budd Co gave 405,000 shares of stock and $642,500 in cash for C-D-F. The 1954 sales for C-D-F were $18 million while Budd's sales totalled $246 million, down $96 million from 1953. The decline was reported due to decreased automobile and defense work.

Timothy F. Murphy, former C-D-F president, said that the company will have access to the engineering talent in the Budd firm. Edward G. Budd, Jr., president of Budd Co and the new company, predicted greater gross business by access to some 6,000 new customers in growing fields such as electronics, communications, electric power, and textile machinery.

Harry K. Collins, vice president and general manager, is chief administrative officer of the new company. He will be assisted by J. Franklin Anderson and Ernest O. Hausman, both vice presidents.

(*More M&M on page* 188)

Rescued from

graveyard by

G-E Service Shop

Get your obsolete distribution transformers back on the pole again—as good as new! Just call your local G-E Service Shop. We'll rebuild them ...uprate them 40% or more ...and return them with new-transformer warranties. There are 31 G-E Service Shops throughout the country—one near you. 431-31

Progress Is Our Most Important Product

GENERAL ELECTRIC

L-M Package Eases Conduit Handling

Line Material Co's Perma-Line fiber conduit is now available in a modular package that facilitates handling and storage. According to W. M. Bloom, product manager, fiber products, the modular idea was adopted by L-M so conduit users could achieve additional economy. The new compact package is designed for use with yard equipment as shown in the illustration.

The conduit—in 5-ft lengths, 2, 4, 5 and 6-in. ID, and in 8-ft lengths, 3, 3.5, 4, 4.5 and 5-in. ID—may be shipped in the modular package. A nominal charge is made for modular packaging.

In addition, L-M offers a sling package method and bulk quantity shipments.

A further step in providing greater customer service is the recent acquisition of open-top trailer trucks to haul fiber conduit from the company's Barton, Wis., and Sherman, Texas, plants to customers throughout the nation.

Westinghouse to Build "Automatic" Factory

A new Westinghouse Electric Corp manufacturing plant, described as "the most highly automatic of any of the company's plants," will be built near Greensburg, Pa., it was announced recently. Bruce D. Henderson, Westinghouse vice president, said the multi-million dollar plant is expected to be completed by late 1955. It will be devoted to the manufacture of semi-conductor devices such as transistors, power rectifiers, high frequency detectors, and photocells. The facility will be operated by the company's newly-formed semi-conductor department.

"This new plant," Henderson said, "ultimately will utilize manufacturing equipment that is the most highly automatic of any in Westinghouse's 56 major manufacturing plants." "This is necessary," he added, "because human hands cannot come in contact with the special materials used in the manufacture of semi-conductor devices without contaminating such materials."

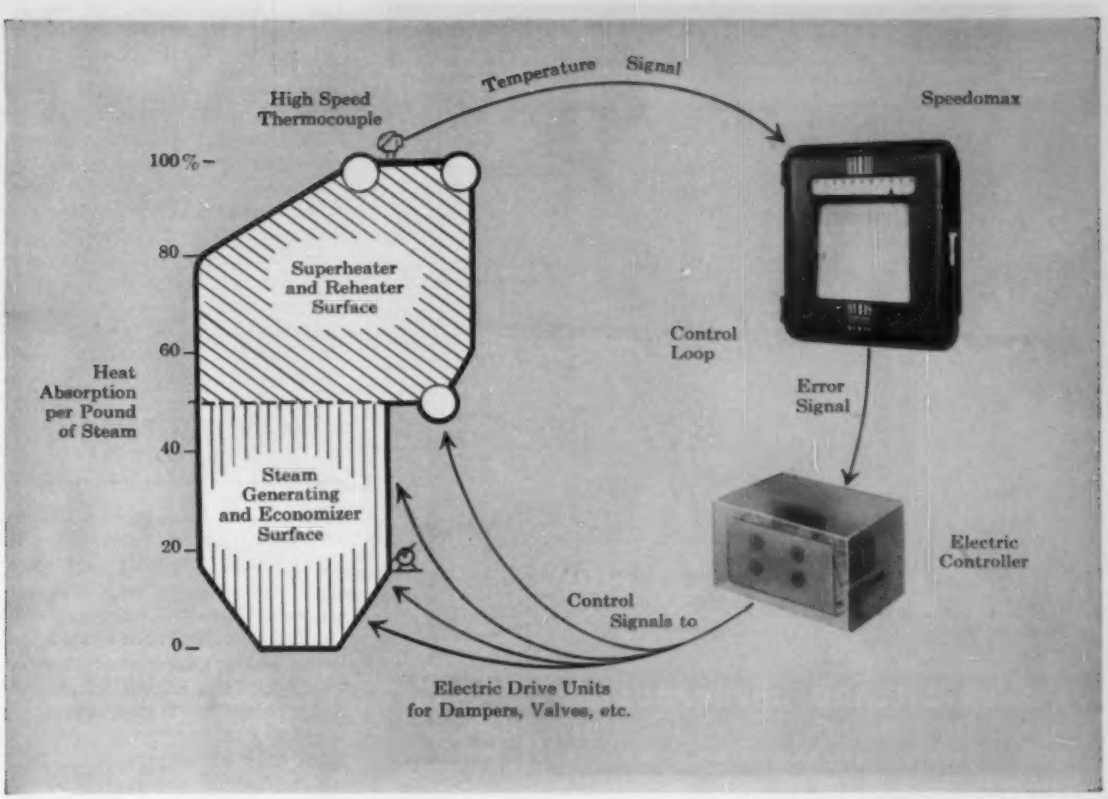
The new manufacturing facility will be housed in a completely air-conditioned windowless building one story high and 520 ft long. An adjacent office structure, also air-conditioned, will be two stories tall.

Monsanto Develops Vinyl Wire Coating Compounds

Monsanto Chemical Co's Plastics Division has developed three new vinyl compounds for wire coatings. The compounds, designated as Opalon 1038, 72254 and 72217 are said to be well suited for wire and cable insulation.

Opalon 1038 is a primary insulation approved for Type T and TW uses and exposure to oil at 60C. Its physical and electrical properties along with ease of processing are said to qualify it particularly for use in large size building wire (No. 6 AWG and

(*Continued on page* 190)



THIS STEAM TEMPERATURE CONTROL

puts heat where you want it!

● Because superheater and reheater surfaces of many modern boilers receive 50 per cent—or more—of the heat liberated, the proper control of heat distribution is a governing factor in attaining efficiency. Steam temperature control, by regulating this distribution, maintains optimum Btu /lb of steam, and helps prevent overheating of the metal surfaces.

L&N's *all-electric* steam temperature control solves this critical problem effectively over a wide range of load and furnace conditions. The basic components of the control are as follows:

High Speed Thermocouples—Especially designed to provide accurate sensing of temperature, with a response several times as fast as non-specialized thermocouples.

Speedomax Recorders—Provide sensitivity, accuracy and proved reliability of measurement; with auxiliary alarms and control safeguards specified for this very exacting service.

Versatile Electric Controller—With control actions–proportional, reset and rate–tailored to meet not only the requirements of a single operating condition (such as control of a valve), but also of *added* operating conditions (as when control must be transferred to dampers or other devices). Preliminary control action, initiated from changes in boiler air flow, is similarly tailored for each operating condition. Reheat unit control systems are coordinated to prevent one temperature control from interacting with or upsetting the other.

Electric Drive Units—Provide dependable, positive positioning of dampers, valves, burners, etc. under conditions both normal and adverse.

Let our engineers work with you to arrive at an effective solution of your superheat—reheat control problems. Please address us at 4938 Stenton Ave., Philadelphia 44, Pa.

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instruments *automatic controls* • *furnaces*

P-L ANCHORS HOLD FOREVER!
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Save up to 85%

brush handling costs

M & M Brush Grinder rapidly converts brush to chips and reduces piling, trucking, and burning costs.

Cut labor and truck operating costs as much as 85%. M & M Brush Grinder chews brush and branches up to 6" in diameter into small chips and automatically blows them over the ground or into a truck. Compact, portable unit with its own power plant. Haul it right to the job by jeep, or truck. Fully enclosed mechanism is protected from dust and dirt and completely safe. Sturdy construction for long, satisfactory service. Write today for illustrated folder.

MITTS & MERRILL 1002 South Water St. • Saginaw, Michigan

85

Wire Coating Compounds

(*Continued from page* 188)

over) and UF-NMC cable. Other properties include mechanical toughness, weather and flame resistance, and performance at low temperatures.

Opalon 72254 is a general purpose, flame retardent, jacketing compound recommended for sheathing applications requiring good physical properties, and low temperature (—40C) and weatherability characteristics.

Opalon 72217 is specifically for switchboard cable jacketing and inside telephone wire jacketing.

MANUFACTURING BRIEFS

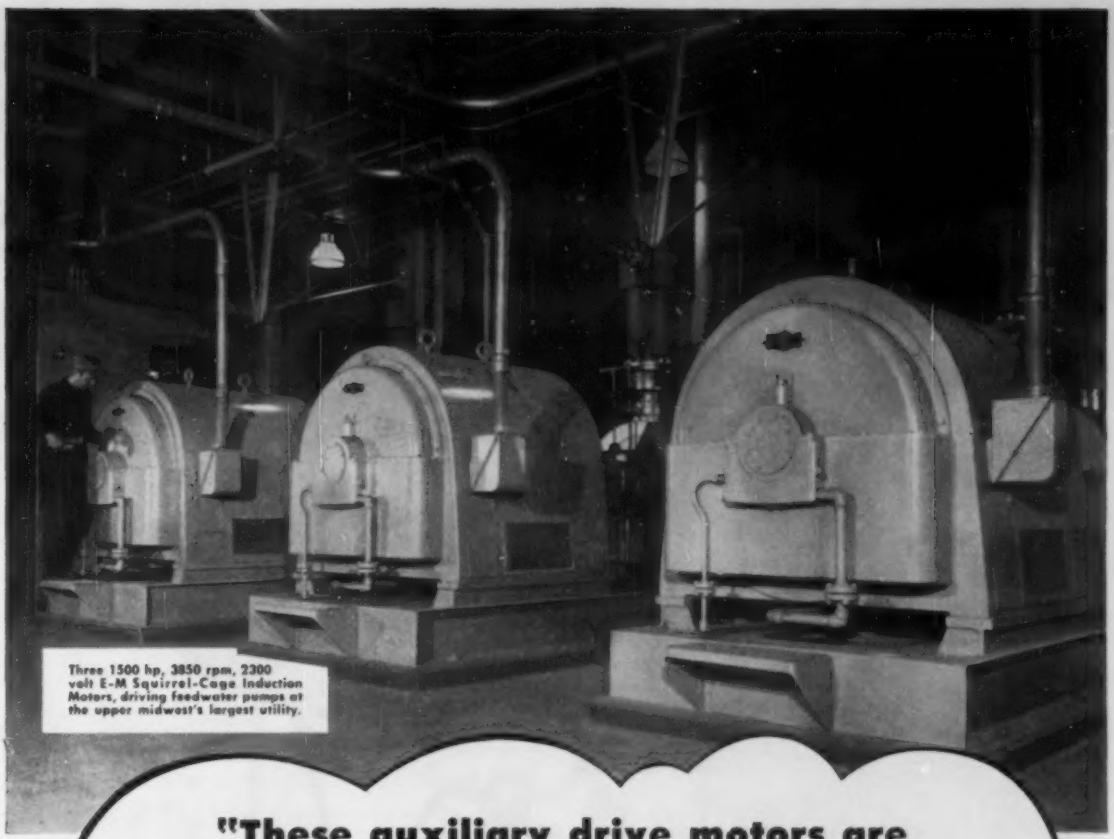
William Brand & Co, Inc of Willimantic, Conn., recently dedicated a new plant at North Windham, Conn. The 60,000 sq-ft building, built at a cost in excess of $500,000, is equipped with wire and tubing extruders of the latest design, and high-temperature ovens for the production of silicone and silicone rubber coated fibrous glass sleeving.

Hays Corp of Michigan City, Ind., manufacturer of power plant instrumentation, has announced the outright purchase of Metrotype Corp, manufacturer of data reduction equipment.

North American Aviation, Inc has awarded a contract in excess of $1 million to Vinnell Co, Inc of Los Angeles for construction of a Nuclear Research Laboratory. Operations at the facility will include design and development of nuclear reactors for generation of electric power, and for medical, industrial and scientific research. Laboratory will be built on 16 acres of a 56-acre site in Canoga Park, Calif. It is scheduled for completion by mid-October.

C&D Batteries, Inc of Conshohocken, Pa., manufacturers of industrial storage batteries has begun operations in a new plant in Attica, Ind.

H. K. Porter Company, Inc has purchased the Vulcan Crucible Steel Co of Aliquippa, Pa., a producer of tool steel. James O. Fowler, president of Vulcan, will be vice president and general manager of the new Porter division. Annual sales of the company are close to $4 million.



Three 1500 hp, 3850 rpm, 2300 volt E-M Squirrel-Cage Induction Motors, driving feedwater pumps at the upper midwest's largest utility.

"These auxiliary drive motors are protected against moisture and vibration!.."

"Large auxiliary drive motors need a lot of extras," says Pete Powerhouse, E-M engineer and specialist in their application.

"We protect stator coils with the best step-by-step 'Power House' insulation process involving vacuum-pressure impregnation and multiple varnishing and baking of the entire winding. Coil ends are ruggedly lashed to one another and to heavy bracing rings to guard against distortion.

"You'll find our motors run smooth and quiet . . . aerodynamic blower design and rotor streamlining keep noise level to a minimum. Speaking of the rotor, we make sure it's stiff, strong and precision balanced. And bearings are *Kolene* processed and centrifugally cast to really last.

"So, if you want to forget about factors such as high humidity, fumes, moisture, vibration, noise, etc., ask your nearest E-M sales engineer to show you why E-M *Customized* Motors are so well suited to exacting power station demands. And be sure to check the publications listed below."

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

Pete Powerhouse says...

"Write the E-M factory for Publications No. 189 and 214, which describe in detail the E-M *customized* design and construction that produces these dependable auxiliary drive motors. They will help you select the motor best suited for your application."

E-M

Specialists in making motors do **EXACTLY WHAT YOU WANT THEM TO**

1300-TPA-2157

SKIMPY WIRING
"Dead End" Kid of the
Electrical Business!
E Gurney

"DEAD END" KID OF THE ELECTRICAL BUSINESS!

Here's what Kennecott is doing about that problem child of your business—SKIMPY WIRING!

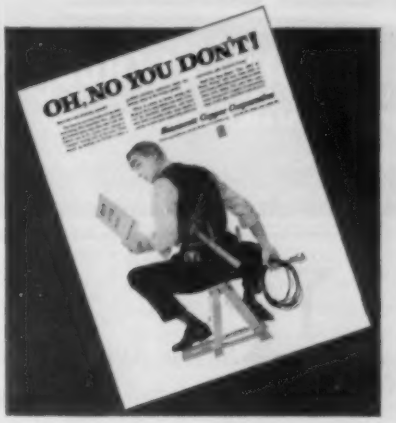
You know this evil little fellow. He's causing the biggest headache in the electrical business today. He keeps your homeowner-customers from getting all the electrical power their appliances need. He keeps *you* from selling all the power you should. He's costing you and your customers thousands of dollars every year.

How can you run Skimpy Wiring out of your territory? Only one way... *intensive education* of the owners of the homes in which Skimpy Wiring is so firmly entrenched today!

That is why Kennecott is running full-page ads like the one shown below in the Saturday Evening Post and This Week magazines. It's a campaign that tells millions of home-owners the vital story of adequate home wiring—and how to get it. It's a campaign that can put the full weight of national advertising prestige behind your own adequate wiring drives in your own area. Tie in with it now!

FREE! TIE-IN MATERIAL!

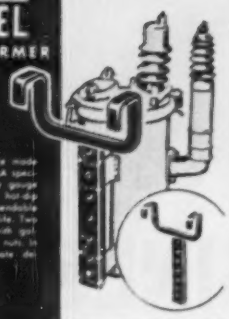
Add punch to your own local drive for adequate home wiring! Send today for free reprints and poster-sized blowups of Kennecott's full-page Saturday Evening Post and This Week magazine ads. Get free copies of the educational booklet, "The ABC of Home Wiring." Ask for complimentary home wiring Wall Chart, mat service folder and list of *at-cost* prices for large-quantity orders of all material available. No cost or obligation! Just write Kennecott Copper Corporation, Dept. W75, 161 East 42nd St., New York 17, N. Y.



Kennecott Copper Corporation

Fabricating Subsidiaries: CHASE BRASS & COPPER CO. • KENNECOTT WIRE & CABLE CO.

THIEL
TRANSFORMER
HANGERS



THIEL Hangers are made according to NEMA specifications — heavy gauge steel construction, hot-dip galvanized for dependable service and long life. Two styles complete with galvanized bolts and nuts, in stock for immediate delivery.

MODEL	1-PHASE	3-PHASE	WEIGHT
T-1	3-15 KVA	9 KVA	15¼ lbs.
T-2	25—37—50 KVA	15-45 KVA	27¼ lbs.

C-TYPE HANGERS
Two sizes - for 75-100 KVA 1-phase and 75-112½ KVA 3-phase transformers.

HANGER KICKERS
In sizes to fit T-type Hangers, — in four and five mounting positions

Electrical Fasteners That Hold . . .

THIEL TOOL & ENGINEERING CO. INC.
1417 No. Market St. • St. Louis 6, Mo.

Remember

. . . in the dynamic

electric power

industry,

only World can do*

World's work . . .*

* **Electrical World**

that is . . .

SPECIFY

Grip-Tite

EXPANDING ANCHORS

GRIP-TITE MANUFACTURING CO.

WINTERSET, IOWA

"Pioneers in the Anchor Field"

IN CANADA: LINE AND CABLE ACCESSORIES, LTD. • TORONTO.

In the dynamic electric power industry, engineers and executives prefer Electrical World 4 to 1 . . .*

* Year after year, advertisers, (and their agencies) survey their best customers and prospects: *"What one publication is most useful to you?"* Almost without exception the preference for Electrical World runs 4 to 1, or better.

SALES ASSIGNMENTS

Company Staffs

Westinghouse Electric Corp has announced these changes in its field sales force: Electric Appliance Division—D. P. Hugo has been promoted from portable appliance salesman in Ohio, Pennsylvania, and West Virginia to district manager in the new district of Knoxville, Nashville, and Chattanooga area: Lamp Division—Joseph F. Kempf, Jr., has been transferred from manager of the Lake Erie district to manager of the Penn-Jersey district; and Electronic Tube Division—David P. McIlmoil has been assigned responsibility for sales of Reliatron tubes in Southern California and Arizona.

Graybar Electric Co, Inc, has announced the following managerial field appointments: J. J. Lieske, Jr, headquarter's representative for government business in Washington, D. C., has been named district sales manager at Chicago; Doral Eardley has been promoted from a salesman covering utility and industrial accounts in the Central Pacific district to Fresno manager; E. W. Windahl, manager at Duluth, has been appointed branch manager at Indianapolis; and D. A. Hilger, manager of inside construction sales at Minneapolis, has succeeded Windahl at Duluth.

J. H. Holan Corp, has designated Ronald E. Hull sales manager in charge of truck body and power equipment sales from the company's Cleveland plant. Hull has resigned as sales manager at Highway Trailer Co, Edgerton, Wis.

Electric Controller & Manufacturing Co has appointed Clayton G. Findlay, member of the Chicago engineering sales staff for eight years, as district manager in St. Louis, Mo.

Electric Storage Battery Co has named Edward A. Holland, one of the company's industrial sales engineers, as assistant manager of the New York City sales branch.

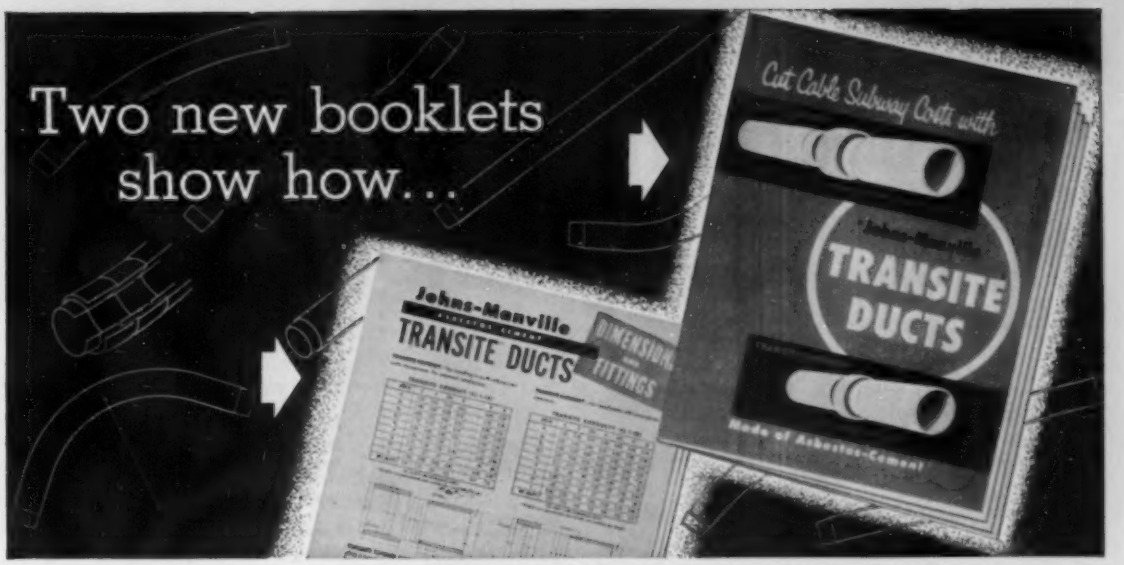
General Electric Co's welding department has established sales offices and warehouses in St. Louis, Mo., and Chicago, Ill. GE has appointed Wendell S. Matchett as central district manager and acting supervisor of Chicago direct sales; Vernon H. Hartley as manager of St. Louis direct sales, and H. Nelson Simon as sales engineer in Detroit.

Representatives

Four Wheel Drive Auto Co has appointed Kimball Equipment Co, 222 West 17th South, Salt Lake City, Utah, as truck sales, parts, and service dealer in Utah.

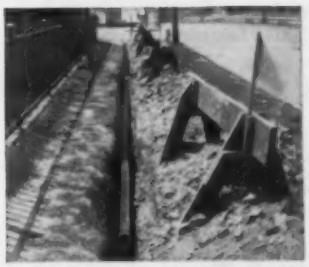
Cochrane Corp has designated Dickey Engineering Co, 2721 Central Ave N. W., Knoxville, Tenn., as sales representative in Tennessee.

J. F. Pritchard & Co has named C. J. Gaskell Co, Inc, of Memphis, Tenn., as sales representative in Western Tennessee, Southwestern Kentucky, Northern Mississippi, Northeastern Arkansas, and Southeastern Missouri for air conditioning and industrial applications, and Pritchard Hydryers.



Transite® Ducts cut cable subway costs—

give greater cable protection



Transite Conduit is the thicker walled duct which is used for exposed work or is laid directly in earth without a concrete encasement. Saves time, labor and materials on the job

Transite Korduct® is the thinner walled duct for installation in concrete. Inasmuch as it is used principally for hi-voltage lines, its high thermal conductivity reduces operating losses

● Johns-Manville presents these brochures as a service to public utilities, design engineers, and all other users and planners of cable subway systems. "*Transite Ducts*" shows how improved cable subway protection, installation, maintenance and operational savings may be achieved. "*Transite Ducts, Dimensions and Fittings*" give the necessary dimensional data on all ducts and fittings.

Transite Ducts offer improved cable subway protection. Made of asbestos and cement, Transite cannot burn, smoke, fume or generate explosive gases. Transite confines arc damage and protects adjacent cables against heat and flame. Transite resists corrosive action of soils; is unaffected by electrolysis.

Installation savings result because Transite is strong, light in weight, easy to handle. It comes in long, 10-foot sections, thus, fewer joints are required. Its permanently smooth bore prevents injury to cable either from natural movement or when pulling cable through. Maintenance savings result from the permanent nature of the asbestos cement composition of Transite. It is as durable as stone.

Moreover, operational savings result because cables run cooler due to the high thermal conductivity of Transite Ducts. This also results in prolonged cable insulation life.

For complete details on how Transite Ducts can cut cable subway costs for your system, send for copies of "Transite Ducts," EL-29A and "Dimensions and Fittings," EL-45A. Write to Johns-Manville, Box 60, New York 16, New York. In Canada, 199 Bay Street, Toronto 1, Ontario.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE DUCTS

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

How Union Electric met the cry for MORE KVA...ECONOMICALLY

Faced with today's universal problem of growing secondary loads, Union Electric Co. of Missouri found a swift economical answer in the new General Electric standard 167-kva transformers.

In one area near Festus, Missouri, Union Electric needed to increase kva capacity and at the same time change distribution voltage from 2400/4160 wye to 7200/12470 wye. It was desirable, however, to use existing poles and to maintain existing clearances. Lightweight, low-height units were obviously required.

The company did the job quickly and economically by installing the new G-E standard 167-kva transformers. The average time for mounting from ground to crossarm was less than five minutes. No special riggings were necessary and no platforms had to be built.

The new 167-kva transformer is another result of G-E research in a continuous program to reduce transformer weight and height. Today the 167-kva unit is ***670 pounds lighter and 14" lower than before.*** It is now in the pole-type class and is available as a standard unit.

Thanks to G-E engineering developments you can now hang distribution transformers of higher kva ratings without replacing poles and without building costly platforms. Let G.E. help solve your load growth problems. Simply call your nearest G-E Apparatus Sales Office. General Electric Co., Schenectady 5, New York. 431-34

Progress Is Our Most Important Product

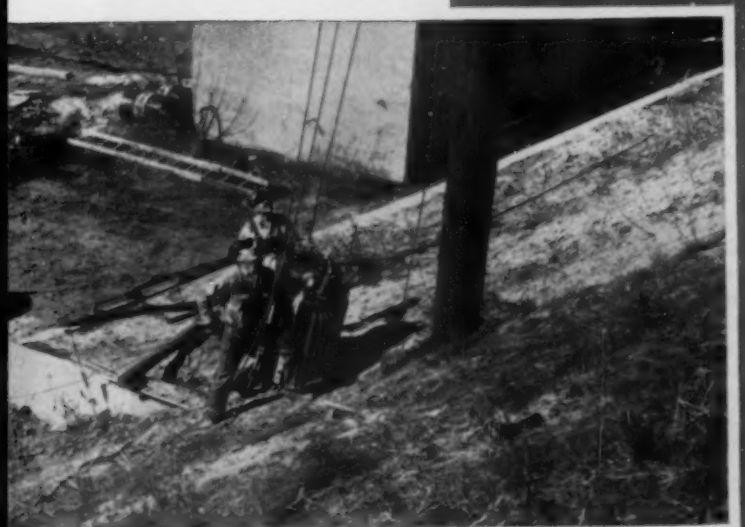
GENERAL ELECTRIC

OLD 167-KVA UNIT VS. NEW STANDARD 167-KVA UNIT

OLD		NEW
2170 lbs.	Weight	1500 lbs.
67 1/4"	Height	54"
740 Watts	Core Loss	550 Watts
1.25% at 1.0 p-f	Regulation	1.25% at 1.0 p-f
3.5% at 0.8 p-f		2.9% at 0.8 p-f

NEW

G-E standard 167-kva unit goes from ground to crossarm in 5 minutes



E. I. HATCH

Hatch Joins Utility as VP

Edwin I. Hatch, Montgomery attorney, has been named a vice president by the board of directors of Alabama Power Co.

At the time of his election, Hatch was a partner in the firm of Martin, Blakey, & Hatch. He has had 19 years' experience in the legal and corporate affairs of Alabama Power.

The new utility executive received an A.B. degree from the University of the South at Sewanee, Tenn., in 1933 and an L.L.B. degree from the University of Alabama in 1936.

Later this year Hatch will move to Birmingham to assume his utility post.

Westinghouse Announces Executive Changes

B. D. HENDERSON

Westinghouse Electric Corp has appointed Bruce D. Henderson, vice president, to the apparatus products staff. A. M. Kennedy, Jr, assistant general manager of purchases since 1952, has been named general manager, purchases and traffic, to succeed Henderson.

Henderson was graduated in electrical engineering from Vanderbilt University in 1937, attended Harvard Graduate School of Business Administration, and then joined Westinghouse. After various purchasing assignments he became assistant to the vice president and general purchasing agent in 1950 and a vice president in 1953.

Kennedy joined Westinghouse's purchasing department in 1941 after graduation from Yale University and a year of advance study at Carnegie Institute of Technology. In 1951 he became director of steel purchases.

A. M. KENNEDY, JR

Craig Appointed General Cable Vice President

C. J. Craig, president of General Insulated Wire Works, Inc, of Providence, R. I., has been appointed a vice president of General Cable Corp as a result of the acquisition of the Wire Works by General Cable. Craig will retain principal responsibility for the operation of the Providence plant.

Craig, a business graduate, joined Whitney Blake Co of New Haven, Conn., when it was formed in 1913. He served in many capacities, including general sales manager, vice president, and a director of the company, through 1939. In July, 1940, Craig formed General Insulated Wire Works, Inc, participating as president, general manager, and part owner. He has continued in these capacities until his present appointment as vice president of General Cable, manufacturer of electrical and communications wire and cable.

With the acquisition of this plant General Cable adds a new line of products to include rubber, neoprene, and plastic power supply cords with molded-on rubber or plastic attachment plugs and devices, electrical cord sets, bulk lamp cords, and portable power cords.

C. J. CRAIG

(*More News About People on page* 200)

To keep in step with your changing business, your communications should be examined periodically. In that way, they never become outdated—always meet your exact needs at the lowest cost. If you have Bell System service, such studies are a continuing activity.

Bell System communications engineers will help you take a good, close look at your communications . . . *at no cost to you!* Their detailed study will help you get the most efficient use of your facilities . . . whether they are long distance, mobile, teletypewriter, or telemetering and supervisory control.

A growing number of power companies are taking advantage of Bell System communications in meeting the demands of modern operation.

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If you are interested in a detailed survey by Bell System communications engineers without charge, call your local Bell Telephone Representative now.

BELL TELEPHONE SYSTEM

TELEPHONE TELETYPEWRITER MOBILE RADIO TELEMETERING AND REMOTE CONTROL CHANNELS

Zinn Heads American Nuclear Society

DR W. H. ZINN

Dr Walter H. Zinn has been elected the first president of the American Nuclear Society, a new group composed of scientists and engineers engaged full-time in industrial, governmental, and educational aspects of atomic energy.

A foremost authority on nuclear reactor design, Dr Zinn is director of the Atomic Energy Commission's Argonne National Laboratory.

Philip H. Sporn, president of American Gas & Electric Co, has been elected vice president of the new group. The 850 members of the society also elected a 30-man board of directors, representing leading atomic energy establishments in this country and abroad.

Texaco Names Foley Executive VP

James W. Foley, vice president and a director of The Texas Co, has been elected executive vice president of the company.

After receiving a degree in petroleum engineering from Texas Agricultural and Mechanical College, Foley joined Texaco in 1932. He served abroad with Bahrain Petroleum Co, Ltd, in which Texaco is half owner.

Returning to the U. S. Foley held various positions in the domestic producing department. He served as assistant to the manager and as assistant to the vice president in charge of domestic producing. Foley became assistant to the board chairman in 1950 and vice president in 1953.

J. W. FOLEY

PERSONAL BRIEFS

Ten members of the American Institute of Electrical Engineers have been named Fellows of the Institute for their outstanding contributions to their profession: The new Fellows-elect are:

Raymond D. Maxson, senior vice president, Commonwealth Edison Co;

Arthur R. Nelson, general superintendent of distribution, Public Service Electric & Gas Co;

William F. Wetmore, director, planning and project engineering department, Detroit Edison Co;

Clarence W. Minard, assistant general manager, Omaha, Neb., Public Power District;

Roy L. Brown, manager, Instrument and Regulator Division, Westinghouse Electric Corp;

Walter C. Johnson, chairman, department of electrical engineering, Princeton University;

William F. Uhl, president, Charles T. Main, Inc;

Guy B. Ballard, vice president and director of Radio and Electrical Engineering Division, National Research Council, Ottawa, Ontario;

Thomas H. Granfield, assistant vice president, Northwestern Bell Telephone Co; and

John T. Hawley, chief electrical engineer, Sanitary District of Chicago.

William O. Turner, president and a director of Louisiana Power & Light Co, has been elected a director of Middle South Utilities, Inc . . . **Nathan B. Higgins,** president of Safe Harbor Water Power Corp, has retired after 41 years in the electric industry.

Honorary membership in the Western Society of Engineers has been conferred on **General Douglas MacArthur,** board chairman of Remington Rand, Inc, and **H. P. Sedwick,** executive vice president of Commonwealth Edison Co.

Henry F. Angus, dean of University of British Columbia, has become chairman of British Columbia Public Utilities Commission. Angus replaced **Percy E. George** who has resigned as chairman but remains a member of the commission.

L. M. Smith, president of Alabama Power Co, has been elected a director of Edison Electric Institute . . . **Howard P. Seelye,** manager of engineering of Detroit Edison Co, has retired after 39 years with the utility.

F. S. Mabry, manager of engineering for the Electronics Division of Westinghouse Electric Corp, has been named to the new post of engineering consultant to the division manager. Mabry is succeeded by **D. R. Tashjian,** manager of the division's government engineering department . . . Minneapolis-Honeywell Regulator Co has appointed **Taylor G. Nelson,** eastern appliance controls sales manager, as sales manager for the Appliance Controls Division.

OBITUARY

Ernest H. Freeman, 78, who retired in 1946 as head of the department of electrical engineering at Illinois Institute of Technology, died in Wilmette, Ill., on June 14.

Arthur R. Fryklund, 61, died in Sacramento, Calif., June 20. In 1953 he had retired as manager at Sacramento after 42 years with Graybar Electric Co.

Henry R. Hayes, 76, died in New York, N. Y., June 29. He was a director of General Public Utilities Corp and a former vice president of Stone & Webster, Inc, New York, N. Y.

John P. Steere, 79, former electric utility owner and operator at Chepachet, R. I., died June 21 at the Rhode Island Hospital.

Maurice Tallon, 52, residential sales supervisor for Southern California Edison Co, died at Santa Ana, Calif., June 20.

H. Carl Wolf, 63, retired managing director of American Gas Association, died at White Plains, N. Y., June 26.

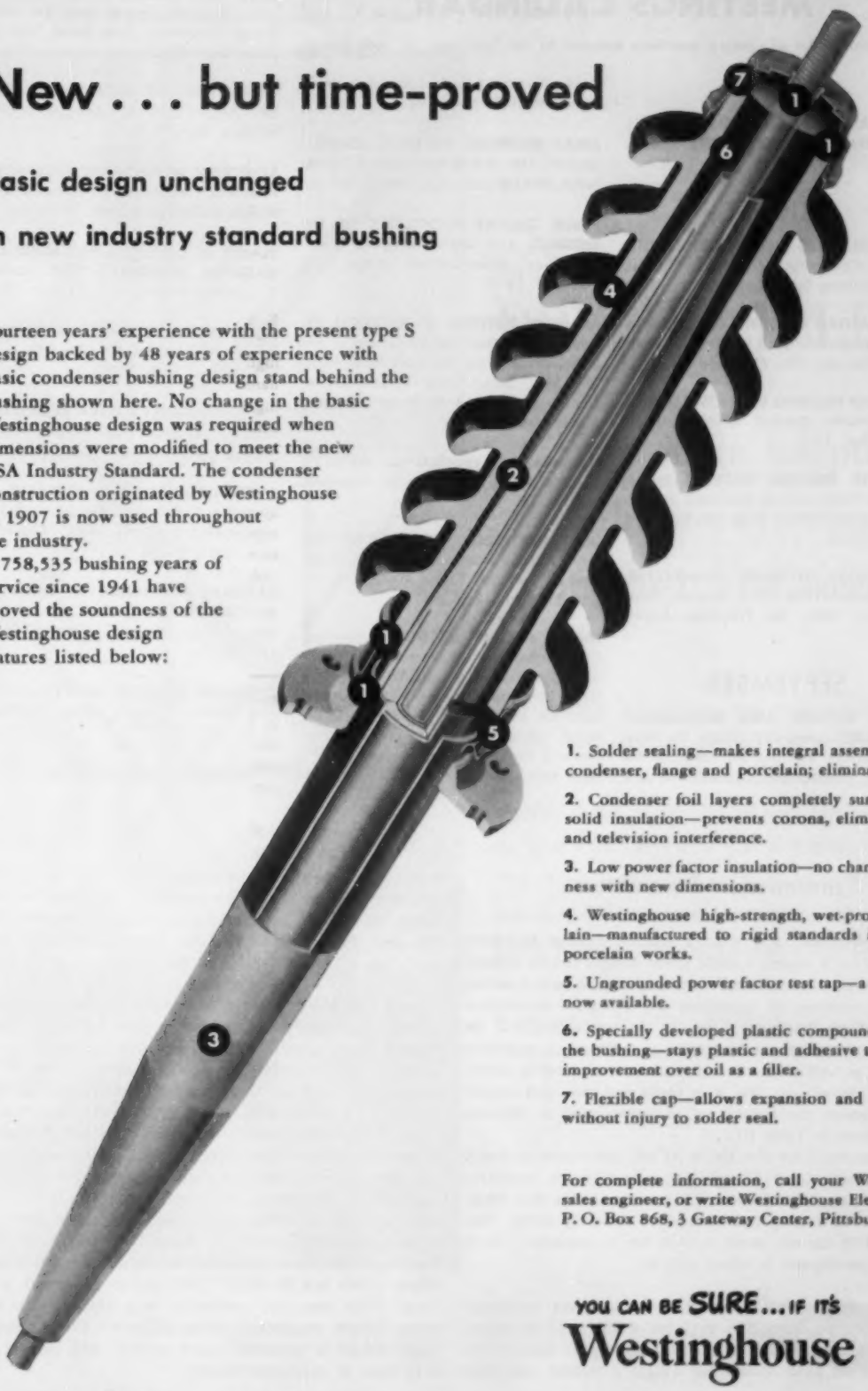
New . . . but time-proved

Basic design unchanged

in new industry standard bushing

Fourteen years' experience with the present type S design backed by 48 years of experience with basic condenser bushing design stand behind the bushing shown here. No change in the basic Westinghouse design was required when dimensions were modified to meet the new ASA Industry Standard. The condenser construction originated by Westinghouse in 1907 is now used throughout the industry.

758,535 bushing years of service since 1941 have proved the soundness of the Westinghouse design features listed below:



1. Solder sealing—makes integral assembly of stud, condenser, flange and porcelain; eliminates gaskets.

2. Condenser foil layers completely surrounded by solid insulation—prevents corona, eliminates radio and television interference.

3. Low power factor insulation—no change in thickness with new dimensions.

4. Westinghouse high-strength, wet-process porcelain—manufactured to rigid standards in our own porcelain works.

5. Ungrounded power factor test tap—a new feature now available.

6. Specially developed plastic compound for filling the bushing—stays plastic and adhesive to −50°C; an improvement over oil as a filler.

7. Flexible cap—allows expansion and contraction without injury to solder seal.

For complete information, call your Westinghouse sales engineer, or write Westinghouse Electric Corp., P. O. Box 868, 3 Gateway Center, Pittsburgh 30, Pa.
J-60876

YOU CAN BE SURE... IF IT'S
Westinghouse

MEETINGS CALENDAR

An extended list of coming meetings appears in the last issue of each month

JULY

NATIONAL HOUSEWARES AND HOME APPLIANCE MANUFACTURERS EXHIBITS—Atlantic City, N. J., July 11-15.

AUGUST

NATIONAL SHADE TREE CONFERENCE—31st Annual Convention, Mar Monte Hotel, Santa Barbara, Calif., Aug. 1-5.

SOUTHEASTERN ELECTRIC EXCHANGE—Personal Administration Section, Roanoke Hotel, Roanoke, Va., Aug. 11-12.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Pacific General Meeting, Butte, Mont., Aug. 15-19.

STANFORD RESEARCH INSTITUTE—Symposium on Electronics in Automatic Production, Sheraton-Palace Hotel, San Francisco, August 22-23.

WEST COAST ELECTRONIC MANUFACTURERS' ASSOCIATION—1955 Wescon Show Fairmount Hotel, San Francisco, August 24-26.

SEPTEMBER

SECOND WESTERN AREA DEVELOPMENT CONFERENCE—sponsored jointly by Stanford Research Institute, the American Industrial Development Council and the Pacific Northwest Trade Association, Multnomah Hotel, Portland, Ore., Sept. 8-9.

ROCKY MOUNTAIN ELECTRICAL LEAGUE—Annual Fall Convention, Grand Teton Lodge, Jackson Hole, Wyo., Sept. 11-14.

PUBLIC UTILITIES ASSOCIATION OF THE VIRGINIAS—37th Annual Meeting, Greenbrier Hotel, White Sulphur Springs, West Va., Sept. 15-18.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—2nd Electrical Conference of the Petroleum Industry, Shamrock Hotel, Houston, Tex., Sept. 12-14; Industrial Electronics Conference, Rackham Memorial Auditorium, Detroit, Sept. 28-29.

ILLUMINATING ENGINEERING SOCIETY—National Technical Conference, Cleveland, Sept. 12-16.

INSTRUMENT SOCIETY OF AMERICA—10th Annual Conference and Exhibit, Shrine Exposition Hall and Shrine Auditorium, Los Angeles, Sept. 12-16.

EDISON ELECTRIC INSTITUTE—Accounting Division Organization Meeting with American Gas Association, Netherlands Plaza Hotel, Cincinnati, Sept. 13-14; Industrial Relations Round Table Conference, Drake Hotel, Chicago, Sept. 19-21; Industrial Power & Heating Group, EEI Headquarters, New York, Sept. 22-23; Purchasing and Stores Committee, EEI Headquarters, New York, Sept. 26; Transmission and Distribution Committee, Jung Hotel, New Orleans, Sept. 29-30.

ASSOCIATION FOR COMPUTING MACHINERY—Annual Meeting, University of Pennsylvania, Sept. 14-16.

SYMPOSIUM OF ELECTRONIC AUTOMATION—University of Pennsylvania, Irvine Auditorium, Philadelphia, Sept. 19-20.

SOCIETY OF INDUSTRIAL PACKAGING AND MATERIALS ENGINEERS — 10th Meeting, Kingsbridge Armory, N. Y. C., Sept. 19-22.

PENNSYLVANIA ELECTRIC ASSOCIATION—Annual Meeting, Benjamin Franklin Hotel, Philadelphia, Sept. 20-21.

* **MISSOURI VALLEY ELECTRIC ASSOCIATION**—Accounting Conference, President Hotel, Kansas City, Mo., Sept. 22-23.

SOUTHEASTERN ELECTRIC EXCHANGE—Engineering & Operation Section, and Subcommittees, Charlotte Hotel, Charlotte, N. C. Sept. 22-23.

NATIONAL ASSOCIATION OF ELECTRICAL DISTRIBUTORS—Pacific Zone, Annual Convention, Empress Hotel, Victoria, B. C., Sept. 25-28.

STANDARDS ENGINEERS SOCIETY—4th Annual Meeting, Hotel Statler, Hartford, Conn., Sept. 29-Oct. 1.

* Additions this week.

EHV Transmission Parameters

(*Continued from page* 107

for comparison, and after a specific voltage has been selected for a system, specific tower designs can be studied.

Fig 4 plots tower steel in tons per mile as a function of the number of insulators for different conductors, obtained by Peterson's formula. As tower height is influenced by clearance to ground, a function of operating voltage as well as number of insulators, an error is immediately introduced. But it is small and does not appear at all unless the number of insulators used is different from those in Table III.

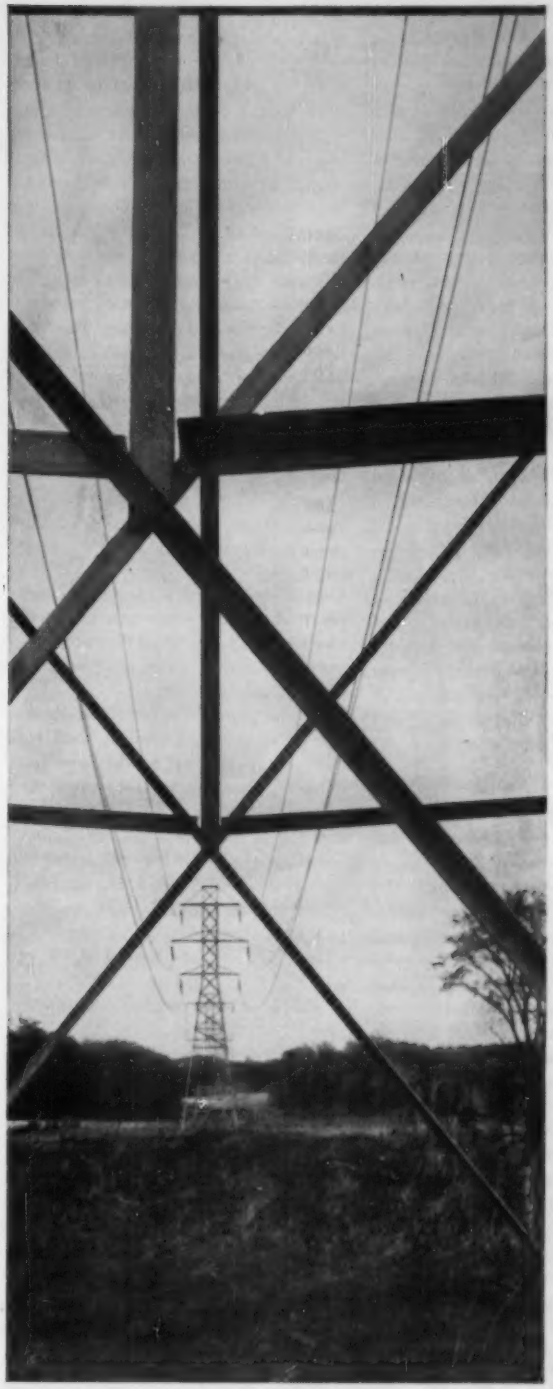
In the curve for 556-MCM ACSR, tower steel is shown as increasing from 27 tons per mile with ten insulators to 38 tons per mile with 21 insulators. On this basis, the cost of raising line voltage is relatively small. But 556 MCM has too small an O.D. for 21 insulators which would correspond to about 400 kv.

Conductor Controls Lower Cost . . . When conductor size is raised from 556 to 1,590 MCM and insulators are held constant at ten, tower weight goes from 27 to 44 tons per mile. Conductor weight is trebled, and total line cost is multiplied by roughly 2.5. Yet for power grid purposes, involving line lengths of the order of 200 miles, the power handling capacity is substantially unchanged. Practically all that has been accomplished is a reduction of losses far below the economic justification point.

Balanced line design requires cutting across the curves of Fig 4 similar to the dotted curve. Once optimum circuit loadings have been determined by calculating board studies or otherwise, the principal electrical design features for economic control are determined by critical examination of Fig 4, or similar curves applicable to local conditions.

It is immediately evident that selection of the conductor is the most controlling influence on line cost, overweighing selection of insulators for a given operating voltage in determining the overall economic balance. Most data on Fig 4 are for solid ACSR, with one curve each for expanded ACSR and a two-conductor bundle of ACSR. Peterson's formula is probably less applicable to the latter. When 1,590 ASCR (O.D. 1.545 in.) is compared with 1.6-in. O.D. expanded conductor, it is obvious that the tower weight required is little different. Consequently, tower weight is somewhat more variable with respect to O.D. than to conductor weight.

from a maintenance point of view . . .



DOW BRUSH KILLERS

cut costs in keeping right-of-ways clear of brush and weeds

Maintenance departments and spray service organizations can rely on specific Dow products doing specific jobs to cut costs of right-of-way vegetation control. It will pay you to get complete information on Dow brush and weed killers and their place in your maintenance program. Write us for information and assistance on the use of Esteron® 245, Esteron Brush Killer and the new brush killer, Kuron. THE DOW CHEMICAL COMPANY, Agricultural Chemical Sales Department, Midland, Michigan. In Canada: Dow Chemical of Canada, Limited, Toronto, Canada.

you can depend on DOW AGRICULTURAL CHEMICALS

DOW

Two New Minerallac Quality Products
Designed for Jobs Too Heavy for
Standard Jiffy Clips

MINERALLAC
Hevi-Duty AND Medium
JIFFY CLIPS

Made of heavier materials! Has exclusive inverted rib, that provides more strength at the bend of clip . . . and, of course, adds the benefits of famous "Snap On" feature!

In stock in Zinc-Plated Steel for ½"—¾"—1" and 1¼" Thin Wall or Rigid Conduit. (Hot Dipped Galvanized may be obtained on order) Can be substituted for malleable clips.

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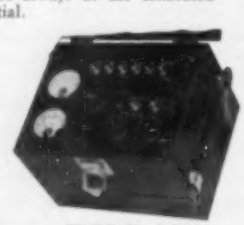
FOR
TESTING POWER METERS

Designed particularly for testing Power Meters, this States unit practically provides laboratory test in the field with potential adjustment from 100 to 125, 200 to 250 so that the input through the load may be always at the calibrated potential.

A 50% Power Factor Test—Single Phase Supply



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Please send me Cat. No. 1 Sec. 1G for further information on Type ID Load.

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Firm .....
City ..... Zone.... State.....

Radial vs Network System Costs

(*Continued from page* 91)

Design Considerations . . . Indianapolis Power & Light's present practice in designing a primary network system is to use a 3,750/4,687-kva master unit substation with four feeder breakers and one bank breaker. Normal loadings of substations are limited to values such that adjacent substations can pick up the load of a unit out of service. This limit approximately equals the self-cooled rating of the transformers. As load grows, units are installed at new locations where they reduce line length, or at existing locations where circuit length is no problem. Only one 34.5-kv source, independent from that serving adjacent substations, normally is brought to any unit.

In radial distribution, as at some of the utility's older substations, a 7,500/9,375-kva unit has been used. A 34.5-kv switching station then assures a firm source for these units. Emergency switching on the overhead lines make it possible to take a feeder breaker out of service for maintenance during light-load periods. These substations are composed of single-phase transformers, and an extra unit is installed in the substation yard for emergency use.

Theoretical and Practical . . . Standard system practices were followed in each study comparing radial and primary network distribution system costs. The theoretical study assumed a square-shaped area. The practical study used an actual section of the north 4-kv primary network area. Uniform load distribution was assumed in the theoretical study. The practical analysis approached the assumed uniform load distribution and actually was based on uniform load for small incremental sections. All calculations were based on 34.5-kv subtransmission. Two subtransmission sources were allowed for each substation in the radial system. The design for the network system provided for single-ended substations with single sources. Thus, the network system design has more substations.

Substation sizes for both studies were assumed to be: for the network system, 3,000/3,750 and 3,750/4,687 kva; and, for the radial system, 7,500/9,375 kva. The utility's 7,500-kva mobile substation influenced selection of the radial system substation size. The theoretical study included $4,000 for substation costs for real estate, and an estimated average cost was assumed for underground feeder costs. Actual cost figures of existing units were used in the practical study.

A maximum allowable circuit loading of 2,300 kva was used, corresponding with present design standards. Network system tie circuits were considered as 2/0 copper. For radial main lines, a graded construction of 4/0 and No. 2 copper was used.

Feeder voltage regulators were estimated for the radial system. The main lines were designed so that maximum voltage drop in any primary section would be 3%. Losses were calculated for each system on the basis of a 40% load factor. Demand losses were charged at $150 per kw and energy losses at $0.004 per kwhr which resulted in an annual cost of $32.00 per kw per year.

Cost Comparisons . . . Annual costs for each system were based on fixed charges of 15.5% in addition to losses evaluated above. Costs covered a ten-year period.

The schedule for installing substations was based on keeping total substation capacity up to the area load demand. Construction costs were then allocated for the ten-year period according to the substation installations. Substation costs were calculated on maximum kva capabilities, or 166% of self-cooled ratings. These were:

Radial substations—$10.30 per kva

Network substations—$14.70 per kva

Three 25-kva regulators—$4,000 per radial installation.

Charges for depreciation, ad valorem taxes and money costs were:

Depreciation—2.75% on depreciable plant.

Ad valorem taxes—3.0% (60% of per $100 assessed valuation)

Money Cost:

Debt—1.875% (50% x 3.75% rate)

Preferred stock—0.80% (16% x 5% rate)

Common stock—3.604% (34% x 10.6 rate).

Only that part of the system which would be different for the two types of design was used in the cost comparison. Lateral lines and secondary systems, considered the same for each, were neglected.

Engineers are saying:

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Public Relations

(*Continued from page* 108)

to remind the executive of a mythical appointment, to the crude method of standing during the interview to show the caller he is not welcome. Perhaps the best of all methods is to prelimit the meeting by announcing at the outset that an important conference is scheduled elsewhere in ten minutes.

4. Interviews With Customers. Although for the executive these may be few, there are two important reasons why they may be more important to the utility than a hundred routine contacts at the service windows.

First, the executive normally is more likely to contact executives of large consumer concerns, and anything that happens in such a meeting may be of vital importance to the welfare of the utility. Second, when the grievance of an average consumer reaches an executive the chances are the case already has been sadly mishandled.

As in the case of the soiled washing, the executive must be able to adjust the most difficult case to the satisfaction of the customer—yet without conceding anything that is not the just due of that consumer.

Some otherwise excellent executives appear to have a blind spot when it comes to improving public relations.

They might say "I simply haven't time for that sort of thing. We're paying complaint adjusters to handle these people."

Making Friends Is Important . . . The operating superintendent mentioned earlier had an answer for this. He said "The public utility is particularly vulnerable to adverse public opinion. When we make an enemy among the citizens of our community we probably have created a dozen ill-wishers, for

EXECUTIVES may unwittingly irritate customers by their telephone manners

that one has friends, neighbors, and relatives, and he's going to talk.

"We can't afford this sort of thing when it can be avoided. For my part, I feel I have done a good job every time I personally turn an irate consumer into a friendly booster. I always try to go beyond the case in point and acquaint this person with a lot of things we are doing to make this community of ours a better place in which to live and do business.

"Any utility executive will spend hours preparing a speech to be delivered before civic or service club groups. Of course, these talks are helpful, but so also are the discussions we have with individual citizens in our offices.

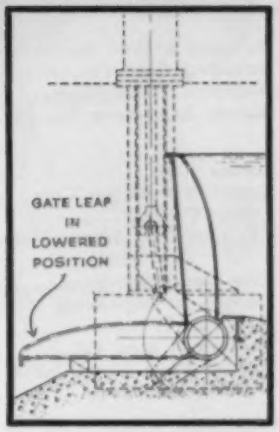
"I want our employees to learn how to make friendly contacts with consumers. But when one of these people falls down I want to be prepared to step in and remove the cause of the misunderstanding.

"If an excutive knows from experience that he is not naturally qualified to adjudicate serious consumer complaints, then he should have an assistant who has a knack for this sort of thing."

EXECUTIVES must be ready to adjust the cases already sadly mishandled.

SMS
BASCULE GATES

These two SMS Bascule Gates, 7′ high and 85′ long, are on the Mississippi River at the Northwest Paper Company's Brainerd, Minnesota, mill. They are shown during a test, with one gate open and one closed. SMS turbines are also installed here for powering pulp grinders and generators.
Consulting Engineers: Hazelet and Erdall.



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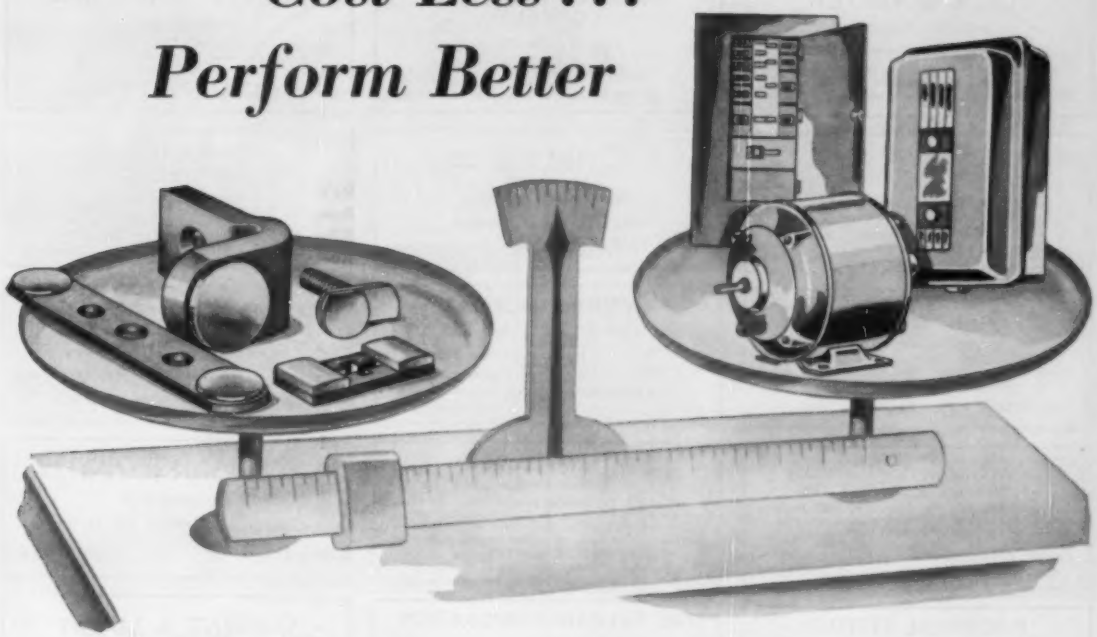

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300	*Ideal	SMM	.8	257
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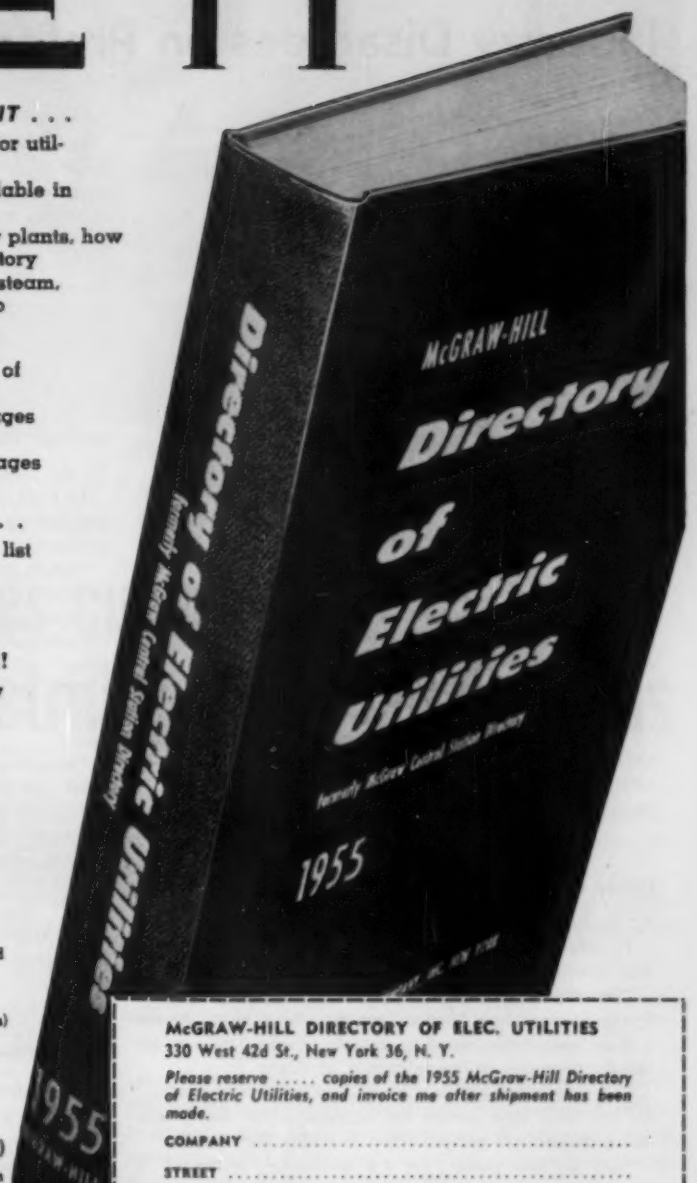

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Industry Disagrees on Preferred Terminology

Consulting Engineer Lists His Preferences

To the Editor:

In answer to your editorial, "We Told Them We Would Ask You," I submit these comments:

Our practice in the executive and other departments varies somewhat, but in our power engineering specifications and mail in general we have adopted the following terms:

"Steam generator," as more appropriate than "boiler."

"Turbogenerator," as more concise than turbine generator. We prefer it in spite of the fact that a great many in industry prefer the longer form. Our use extends back and is tied into the use of "turboblower" in our steel-industry work. As a comparable, up-to-date word I mention the word "turbojet" now in common use.

"Pound per hr." Our standard omits periods after abbreviations. The words "of steam" are omitted as superfluous in the use under discussion, ie, speaking of steam generators.

"Kilowatts" vs "Megawatts." Probably from habit dating back many years we use the former. But units are now of such size that it is my personal opinion ratings should be expressed in Megawatts.

Nuclear power plant. We consider it more exact.

Charles W. E. Clarke
Vice President and Consulting Engineer
United Engineers & Constructors, Inc
1401 Arch St
Philadelphia 5, Pa.

Utility Engineer Has Other Preferences

To the Editor:

In reference to your editorial on terminology in the May 2 issue:

"Steam generator" is more preferred and enjoying more increased use than is "boiler," for the former term conveys a sense sufficiently broad to include all the auxiliary apparatus necessary to the generation of steam.

"Turbine-generator" is preferred over "turbogenerator," for the latter term carries the impression that the turbine and generator are integral when in reality they are not.

Stick to "heat pump," for it is more likely to convey to the layman a relationship to his domestic heating system as compared to "electric air" or "electric air conditioning" which he presently associates with the box on the window sill.

"Adequate wiring" is just that and conveys an idea everyone understands. Too many older homes are inadequately wired for today's appliance demands.

For boiler ratings adhere to "pounds of steam per hour." It is used predominately by the manufacturer and in the field. There is a tendency to employ "boiler megawatts" when reporting boiler outages, but its use is confined within the utility.

When dealing with large generating units or systems use the prefix "mega." It will be accepted by nearly everyone.

Employ the term "nuclear power plant" for it bears a consoling attitude to the layman who still shudders at the mention of "atomic" and its relationship to the war years and atom bombs.

Fred M. Southworth
General Engineer
Consumers Power Co
Box 715
Muskegon, Mich.

Mexican Engineer Makes His Contribution

To the Editor:

In reply to your editorial seeking opinions on industry terminology (EW, May 2, p39), let me make these suggestions:

"Steam generator" instead of "boiler."

"Electric air conditioning" instead of "heat pump."

"Turbogenerator" instead of "turbine generator."

"Adequate wiring" instead of "wired for electrical living."

"Btu per hr" keyed to output or both input and output instead of "boiler Megawatts" or "pounds of steam per hour."

"Megawatts and Megawatt hours" instead of "kilowatts and kilowatt hours."

"Fission power plant" instead of "nuclear power plant" or "atomic power plant."

Read meters in multiples of 10 kwhr.

Ing. J. L. Sarabia
Cia. Minera de Penoles
S. A. Apdo. 291
Monterrey, N. L.

Tailored Wiring Suggested for Adequate Wiring

To the Editor:

When I was glancing through a recent issue of Electrical World, I noted with some interest an editorial relating to a possible alternate term for "adequate wiring." The thought struck me that the phrase "tailored wiring" with the somewhat obvious implications would be more descriptive and at the same time be one that would strike the public's fancy. In a sense it seems to me that the phrase I suggest implies what we want it to imply, that the wiring in a given house is tailored to the needs and desires of the people who are occupying that house.

M. K. Brown
System Supervising Engineer
Niagara Mohawk Power Corp
Buffalo, N. Y.

• Tailored wiring could be inadequate.

Line patrol. The Universal 'Jeep' carries patrol and service crews and equipment along the right of way to structures in off-road locations. It travels in conventional 2-wheel drive at highway speeds, but shifts easily into 4-wheel drive for extra traction to go through mud, soft earth, sand or heavy brush—or climb steep grades—where other vehicles can't go.

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WASHINGTON COMMENT

Hoover Report Seeks Supporters

Embodies philosophy of Moreell task force on water and power modified in some points to avoid headon attack of public power advocates in Congress

Political considerations have prompted the Hoover Commission to modify the findings and recommendations of its task force headed by Adm Ben Moreell. The commission's report on water and power was written with a view to getting the main proposals of the task force through Congress.

The unit headed by Moreell, who is Jones & Laughlin Steel Corp board chairman, prepared a 1,800-page report (see EW, July 4, p 8) calling for revision of federal power policy. Perhaps its most controversial recommendation is disposal of major holdings, such as the Tennessee Valley Authority's system, to local utilities, public as well as private.

Many Moreell's Suggestions Taken . . . While the majority of the 12-man commission adopted many of the Moreell group's suggestions, it sought to make certain basic points more generally acceptable. It did this despite Hoover's personal agreement with Moreell on government philosophy.

A basic point in the Hoover report is a proposal to stop building federal steam plants. It will get solid Republican backing because it's part of Eisenhower's philosophy. Put the Federal Power Commission in charge of government power rates, says the Hoover group. This too coincides with the administration's thinking and will have the support of the Budget Bureau.

Invite private enterprise to put up the capital for power portions of huge federal projects, Hoover recommends. Again, an administration policy.

Thus the Hoover unit's basic suggestions are intimately tied in with Eisenhower's power program. They add powerful support to the President's plans.

Holifield Dissents . . . Loudest thus far in dissent to the report is Commission Member Chet Holifield, Democratic Congressman from California. His opposition shows why Moreell's report was revised somewhat before presentation to Congress. A public power supporter, he brands even the commission's version "negative and divisive."

"The power recommendations," Holifield said, "follow the private utility line in that they destroy present benefits of low-cost federal power development and leave future development in the main to private interests."

This, in a nutshell, is the argument of public power Democrats on Capitol Hill. Had the commission adopted Moreell's suggestions, these Democrats would have pounced upon it. Even in the modified version the proposal to halt building federal power plants will come under heavy fire from the Democrats. Future expansion of TVA and the federal system in the Northwest hinge now on steam.

Hoover has been around Washington a long time. He knows the value of moderation, particularly when dealing with the Capitol. By voting to eliminate some of the Moreell group's suggestions, he hopes to get what's left through a jittery Congress facing re-election next year.

TECHNICAL NOTES

Thermal gain may exceed 2% in overall steam plant efficiency when combustion air is heated with steam instead of merely passing through the preheater.

Half-speed stable operation of 3-phase induction motors can be accomplished by inserting proper resistance in one phase. But voltage must be reduced to avoid saturation of the core steel.

Earth-return 7.2-kv 1-phase lines in Australia must be 250 ft from parallel communication and carry not over 8 amp. Tail-end faults are limited to 56 amp and must clear within 2 sec.

Erratic climate may preclude use of metered kwhr as measure of distribution transformer loading, especially where air conditioning is an important load component.

Thermal neutrons are those having velocities about the same as solid-state molecules at room temperature.

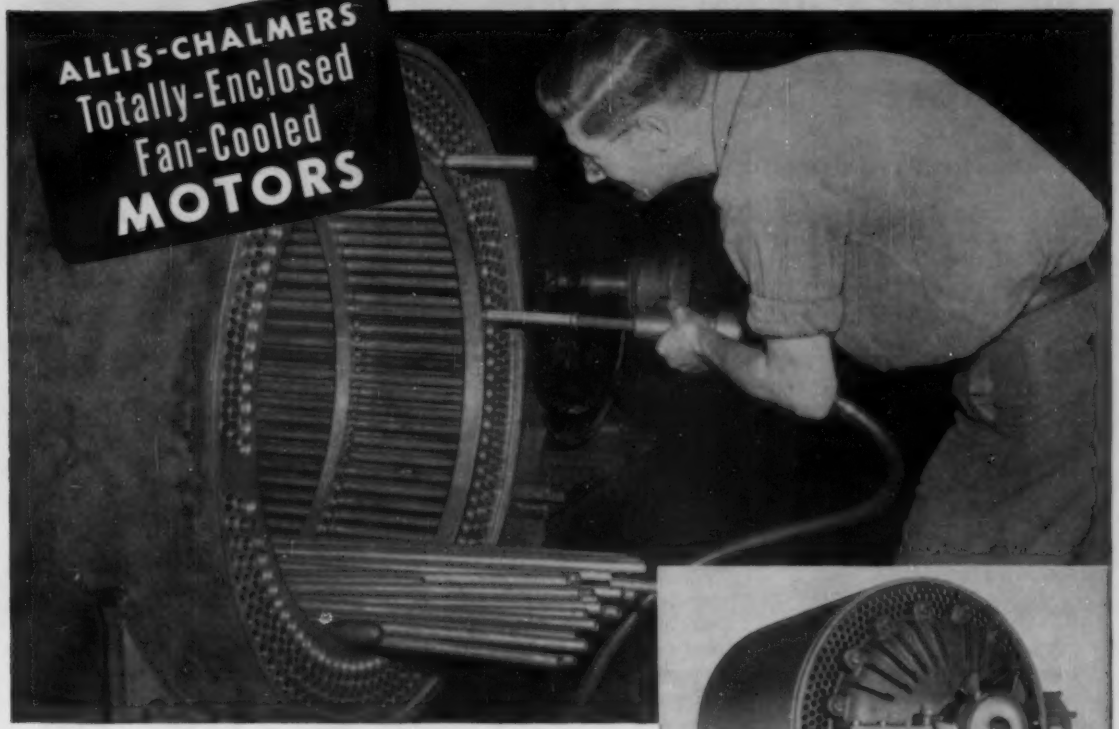
Voltage drop of 10% cuts electric heat 19%, incandescent light 31%, and may black out fluorescents. Motors draw 11% more running current and lose 10% hp, 19% starting and running torques, and 2% in full-load efficiency.

Carrier losses in power cable are probably of the same order as those for coaxial cable which range from 0.2 db per 1,000 ft at 20 kc to 0.9 db at 300 kc.

Reconductoring two 3/0-copper 69-kv lines with 397.5 MCM ACSR can be less costly than building a third line to meet load growing at a 6% rate.

Reheat stop valves are reportedly favored by a majority of utilities and have been adopted as standard turbine equipment by one manufacturer.

High frequency motors (400 cps) at 950 v give almost double the hp in a naval destroyer for half the weight and space of conventional 60-cps 450-v equipment.



3600-rpm explosion-proof motor with fan housing removed to show unidirectional fan.

These heat exchanger tubes

Protect this motor from dirt and corrosion

COOLING AIR is carried through the heat exchanger tubes with sufficient velocity to expel practically all kinds of dirt. If oily or sticky dirt should cling, tubes can be ramrodded clean on the spot in a few minutes because tubes are straight and tube ends are exposed. Also, the tubes are distributed uniformly around the perimeter of the stator yoke and along its full length — cooling all parts of the motor evenly.

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You can lick corrosion with this motor, too. Tubes are available in a variety of materials to meet practically any corrosive atmospheric condition. Allis-Chalmers tube-type motors have long and successful experience in such difficult applications as caustic plants, refineries and petrochemical plants, power plants with fly ash problems and many others.

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Next time you need a motor for a dirty or corrosive location or for outdoor operation in all kinds of weather, call your Allis-Chalmers District Office. Get complete information on Allis-Chalmers tube-type totally-enclosed, fan-cooled and explosion-proof motors. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B7149. Available in ratings on frames larger than NEMA 505 up to 3000 hp.

A-4519

ALLIS-CHALMERS

3 More PSC's Rule On Depreciation

The state regulatory commissions of Illinois, West Virginia, and Virginia recently issued accounting orders with respect to the treatment of Federal Income taxes under the liberalized depreciation provisions of Section 167 of the Internal Revenue Code of 1954.

In petitioning the Illinois Commerce Commission, the Commonwealth Edison Co asked, in substance, for normalized taxes and reserve accounting for the tax deferral. In its petition, the company noted that it will ". . . not transfer such reserve or any portion thereof, except as provided by the terms of any order entered on the petition, without the prior authorization of the commission."

Illinois Commission Ruling

The commission, in acceding to the company's request for its proposed accounting treatment, said: "The company should be afforded the opportunity of utilizing the accelerated depreciation authorized by the Internal Revenue Code, particularly in view of the **important national policy such depreciation provisions were designed to advance."** (Emphasis supplied).

The order continued: "It appears that accelerated depreciation is, in essence, a deferment of income tax liability with respect to the facilities affected. It is accordingly appropriate that current operations should be charged with provisions for estimated future liabilities for federal income taxes deferred by reason of accelerated depreciation. This in no sense carries forward any income for future disposition but rather provides for deferred liabilities. However, credits resulting from provisions for taxes in excess of those currently payable should not remain free and unrestricted in the hands of the utility but should be earmarked in a reserve to provide for meeting in the future the tax liability so deferred."

The orders of the Public Service Commission of West Virginia and the Virginia Corporation Commission, both with respect to the Appalachian Electric Power Co, are identical in all practical respects. In substance both orders provide for the use of normalized taxes (i.e. taxes which would result from the use of straight line depreciation) and the corresponding crediting and debiting of a restricted earned surplus with the amount of the deferral.

Both orders noted the intent behind the use of accelerated depreciation when they said: "It further appears that it was the intent of the Congress of the United States, as stated in the Act, in enacting the provisions of such Code to encourage and stimulate new investment and economic activity by providing funds for new construction and facilities by the deferral of income taxes by such methods, and that applicant will be enabled to have funds available for the financing in part of its construction requirements by reason of using accelerated depreciation and thus be able to defer the issue of a portion of new securties which otherwise would be required if its construction program is to go forward in orderly fashion without delay."

Accounting Details

The following are the accounting details of the order of both commissions:

a. "To account on its books for that portion of its properties which are the subject of accelerated depreciation pursuant to its election under Section 167 of the Internal Revenue Code of 1954 in the same manner as its other properties, and to accrue depreciation therefor at rates consistent with its rates for like property not subject to accelerated depreciation.

b. "During those years of the service life of any of its properties which are the subject of accelerated depreciation pursuant to its election under Section 167 of the Internal Revenue Code of 1954, in which a deferral of federal taxes on income results from the use of the accelerated depreciation deduction in lieu of the deduction allowable under the tax depreciation method theretofore followed, to charge to 'Provision for Future Federal Income Taxes', and to credit to 'Earned Surplus Restricted for Future Federal Taxes on Income' an amount or amounts in total for each year equal to such deferral of taxes.

c. "Commencing with the year in which its deduction of depreciation for federal tax purposes in respect of any of its properties subject to accelerated depreciation is less than such deduction otherwise would have been if depreciation on such properties had been computed at rates consistent with its depreciation rates for federal tax purposes for like properties not subject to accelerated depreciation, and continuing until 'Earned Surplus Restricted for Future Federal Taxes on Income,' applicable to such properties is exhausted, or such properties are retired from service, to charge to 'Earned Surplus Restricted for Future Federal Taxes on Income' and to credit to 'Current Federal Income Taxes Deferred in Prior Years' an amount or amounts in total for each year equal to the increase in federal taxes on income resulting from such federal tax depreciation deduction.

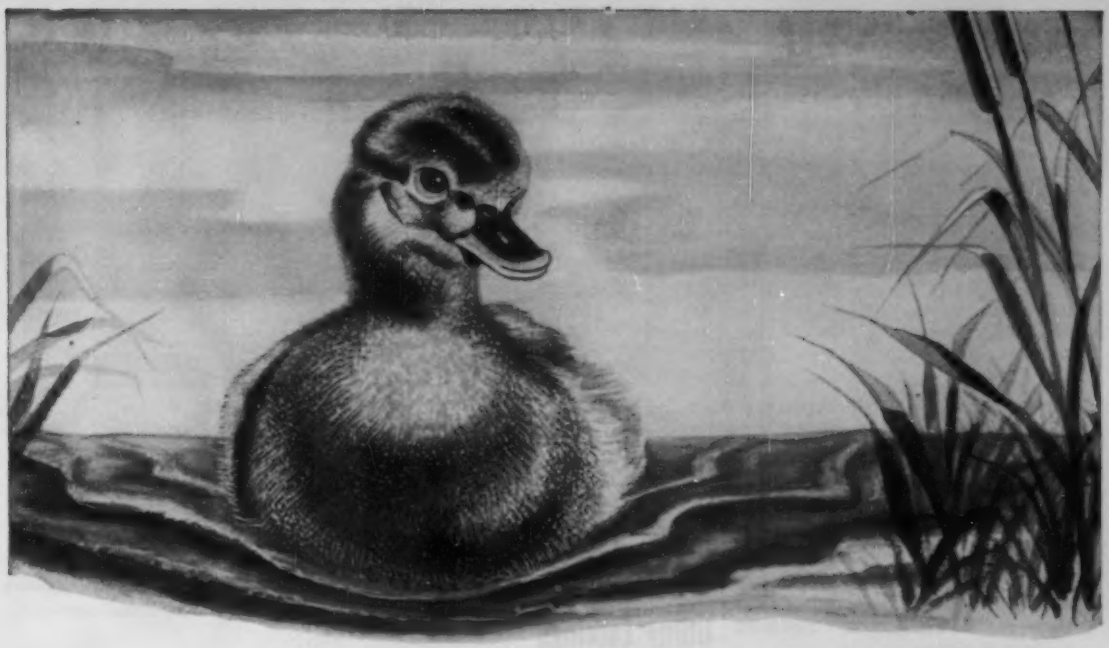
". . . That the authority herein granted is subject to the express condition that the approval granted herein does not bind this commission as to any matter involved herein in any rate proceeding or any other proceeding before this commission in which the applicant may be a party where this matter is considered, and further the commission reserves the right to change, modify or cancel such authority at any time upon the application of any interested party or upon its own motion," the commission orders of Virginia and West Virginia concluded.

N. Y. Analyst Society Names Utility Committee

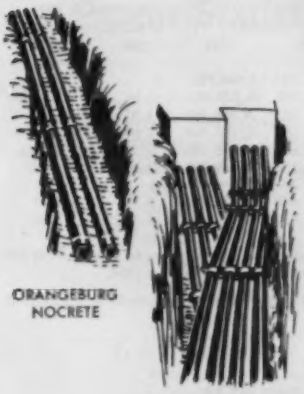
The New York Society of Security Analysts has announced the members of its Utility Program Committee for 1955-56.

They are: C. E. Trefthen, Goldman, Sachs & Co, chairman; David Cowan, Shearson, Hammill & Co; Marjorie H. Cruthers, Irving Trust Co; Maurice E. Dixon, Merrill Lynch, Pierce, Fenner & Beane; Frank P. Glass, Chemical Corn Exchange Bank; David W. C. Rothrock, Lionel D. Edie & Co, Inc,

(*Continued on page* 220)



SO SMO-O-O-OTH!



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Depreciation Rulings

(*Continued from page 218*)

and Alvord D. F. Stearns, The Hanover Bank.

The Society has designated Wednesday as the day for its utility luncheon forums. At each meeting which includes a talk, usually by a utility company president, followed by a discussion or question period, the analyst is able to get a better understanding of a utility company and the policy of its management than can be obtained from published sources.

At the same time the forum affords the management of a utility an opportunity to become better acquainted with the thinking and needs of analysts and representatives of the New York financial institutions.

Printed copies of talks and other material are often sent to the 2,100 members of the NYSSA and frequently to the 4,600 members of the National Federation of Financial Analysts Societies.

The committee invites speakers from a representative group of both large and small companies in the utility business and from federal and state public service commissions. If interested, write C. E. Trefthen, Goldman, Sachs & Co, 30 Pine St, New York 5.

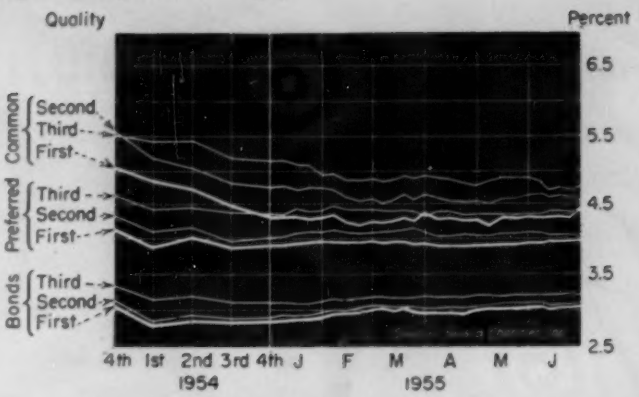
FINANCIAL BRIEFS

First Boston Corp has just issued its 22nd edition of "A Tabulation of Electric and Gas Utility Co Common Stocks." For copy write, George Perrin, vice president, 100 Broadway, New York 5.

Southern Colorado Power Co will sell 20,000 shares of its 4.72% cummulative $50 par preferred stock. It will be offered by an underwriting group headed by Stone & Webster Securities Corp, and Paine, Weber, Jackson & Curtis . . . **Central Maine Power Co** is planning to sell additional common stock this fall, Pres W. F. Wyman said in a letter to stockholders recently.

Stockholder Subscriptions . . . Kansas City Power & Light Co stockholders subscribed for 240,557 shares out of 245,000 offered on a 1-for-10 basis at $37 a share; balance of 4,443 shares has been sold through First Boston Corp-Blyth & Co, underwriters.

Today's Utility Yields—(%)



	BONDS			PREFERRED STOCKS			COMMON STOCKS		
QUALITY.....	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
June 30.....	3.03	3.09	3.21	3.97	4.06	4.37	4.37	4.52	4.74
June 23.....	3.03	3.08	3.22	3.97	4.06	4.38	4.29	4.56	4.71

Utility Earnings

COMPANY	PERIOD MONTHS ENDED		NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
Alabama Power.....	12	May	$13,402,293	12,915,782	$....	$....
Consumers Power.....	12	May	27,486,069	25,730,011	3.23(a)	3.16(a)
Gulf States Utilities.....	12	May	9,843,023	9,518,051	1.97	1.89
Iowa Southern Utilities.....	12	May	1,309,693	1,205,049	1.59(b)	1.45(b)
Ohio Edison, consolidated.....	12	May	21,625,629	19,595,506	3.25(a)	3.06(a)
Portland General Electric.....	12	May	4,753,107	3,979,553	1.88	1.33
Texas Electric Service.....	12	May	10,487,306	9,566,027	....	....
Texas Utilities and subsidiaries	12	May	23,643,668	19,885,433	4.00	3.37
Virginia Electric & Power.....	12	May	18,145,630	14,029,450	2.41(c)	1.96(c)

Notes—(a) Based on average shares outstanding; (b) Based on 747,983 shares in 1955 and 741,971 shares in 1954, and (c) Based 6,600,000 shares in 1955 and 5,999,980 shares in 1954.

Utility Financing

COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
JUNE 30—JULY 6			
PREFERRED STOCK			
Idaho Power—15,000 sh $100 par 4%.....	$1,500	$100.00	4.00%
COMMON STOCK			
Long Island Lighting—624,170 sh (being offered commonholders on 1-for-10 basis, record July 1 to expire July 18; additional 33,543 sh being offered to employees, with a maximum of 200 shs per employee)	$12,795	$20.50	4.88%
SCHEDULED FOR JULY—AUGUST			BID DATE
PREFERRED STOCK			
Consumers Power—100,000 sh.....	$10,000	.....	July 21(a)
Northern Indiana Public Service—120,000 sh $100 par	12,000	.....	(b)
COMMON STOCK			
Consumers Power—373,689 sh (to be offered commonholders on 1-for-20 basis, record July 21 to expire Aug. 5; unsubscribed stock to be offered to employees).....	.....	.....	.....

Notes—(a) Morgan Stanley & Co group, underwriters, and (b) Central Republic Co—Blyth & Co—Merrill Lynch, Pierce Fenner & Beane group, underwriters. Issue will be offered during the week of July 11.

STATISTICS

Score Sheet on Industrial Use of Energy

(million kwhr)

	USE						SUPPLY			
	Manufactures	+ Extracting (estimated)	+ Government Manufactures (estimated)	+ Atomic Energy Commission	+ AEC Generation Net own use	= Total	Industrial Purchases	+ Industrial Generation	+ Adjustment*	= Industrial Purchases & Generation
1946	122,050	11,701	1,701	3,325	1,300	137,477	102,516.3	46,430.9	11,470.2	148,947.2
1947	140,947	12,950	2,300	3,325	1,300	158,222	116,998.0	51,661.5	10,437.5	168,659.5
1948	155,881	13,300	2,500	3,450	1,350	173,781	127,536.3	54,110.4	7,865.9	181,646.9
1949	152,910	13,600	2,700	3,650	1,375	171,485	124,158.9	53,996.8	6,670.7	178,155.7
1950	177,504	15,800	3,000	3,950	1,450	198,804	144,478.7	59,533.0	5,207.7	204,011.7
1951	194,826	16,300	3,000	7,600	1,690	220,036	164,368.6	62,685.1	7,017.7	227,053.7
1952	200,986	16,700	3,000	9,700	1,850	228,536	174,127.5	63,837.0	9,422.5	237,958.5
1953	216,898	17,100	3,000	14,600	2,070	249,528	190,530.9	71,504.6	12,506.5	262,034.5
1954p	217,950	16,500	3,000	31,700	2,775	266,375	208,464.7	72,958.7	15,048.4	281,423.4

p—preliminary
Source: Compiled from data published by Federal Power Commission Bureau of the Census, and Atomic Energy Commission

*Sales to utilities from industrial generating plants plus adjustments due to changes in customer classifications.

Power Statistics . . .

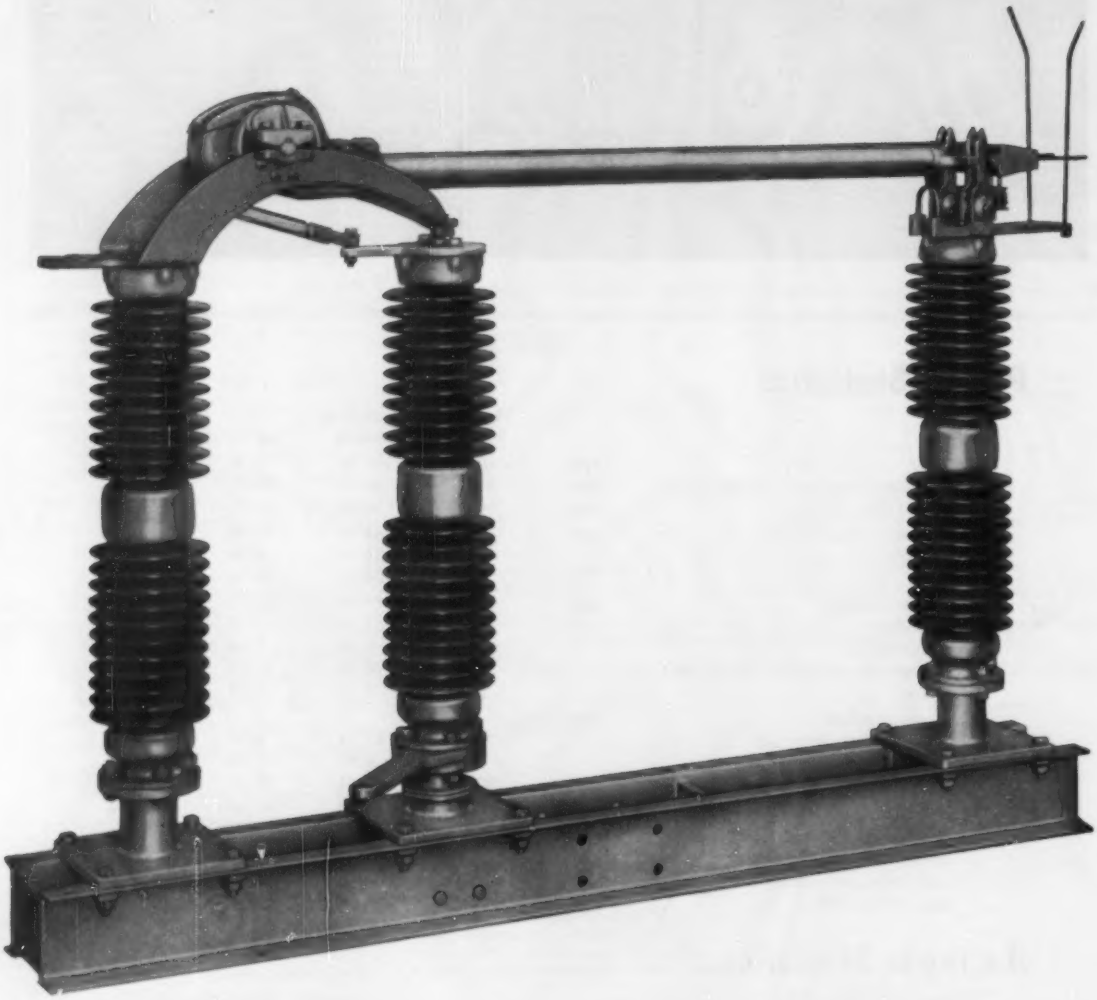
		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Apr.	105.30	104.93	93.56	12.5
Peak—Class I Systems (million kw)	Apr.	82.4	83.4	73.7	11.8
Estimated Dec. '55 Peak	Mar.	96.5	96.4	96.0	0.6
Production—billion kwhr	Apr.	42.03	44.45	36.84	14.1
hydro		10.47	10.40	9.91	5.6
fuel		31.56	34.05	26.93	17.2
Sales—billion kwhr	Apr.	39.56	39.94	34.13	15.9
residential		10.54	11.08	9.57	10.1
commercial		6.14	6.20	5.69	7.9
industrial—includes sales to AEC		20.51	20.36	16.73	22.6
other		2.37	2.29	2.12	11.6
Fuel Consumption	Apr.				
coal—million tons		10.12	11.51	8.68	16.7
oil—million barrels		5.68	6.81	4.78	18.7
gas—billion cu ft		92.82	83.41	91.10	1.9
Net Income Class A & B Co's—$ million	Apr.	105.46	107.80	95.87	10.0
Residential Customers—millions	12 mos.	43.44	43.35	42.15	3.1
revenue per kwhr	ended	2.68¢	2.68¢	2.72¢	−1.5
avg. kwhr per customer	Mar.	2,606	2,587	2,400	8.6
avg. annual bill		$69.84	$69.33	$65.28	7.0

Business Statistics . . .

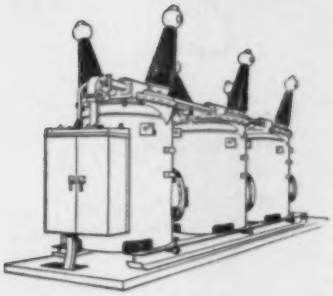
Indexes: 1947–49 = 100					
FRB Industrial Production	May	137	138	124	10.5
ENR Construction Cost	June	137.5	137.0	130.5	5.4
BLS Cost-of-Living	May	114.2	114.2	115.0	−0.7
NEMA Sales	Apr.				
insulation materials		160	160	124	29.0
electric appliances		105	126	97	8.2
household refrigerators		96	106	73	31.5
Wholesale prices	May				
motors and generators		120.8	120.5	124.1	−2.7
transformers and regulators		127.3	127.3	128.1	−0.6
switchgear and fuses		135.6	135.5	135.1	0.4
GNP—annual rate—$ billion	1st Qtr.	$370.0	$362.0	$355.8	4.0

Cole Electric Co.

8439 Steller Drive | TExas 0-4701 | Culver City, Calif.



AIR BREAK DISCONNECTING SWITCH
69,000 Volts—1200 Amperes
Type 0-2
Vertical Break, Three Pole, Single Throw
Group Operated—One Pole Shown
HIGH PRESSURE SILVER TO SILVER CONTACTS
See Bulletin 46-A

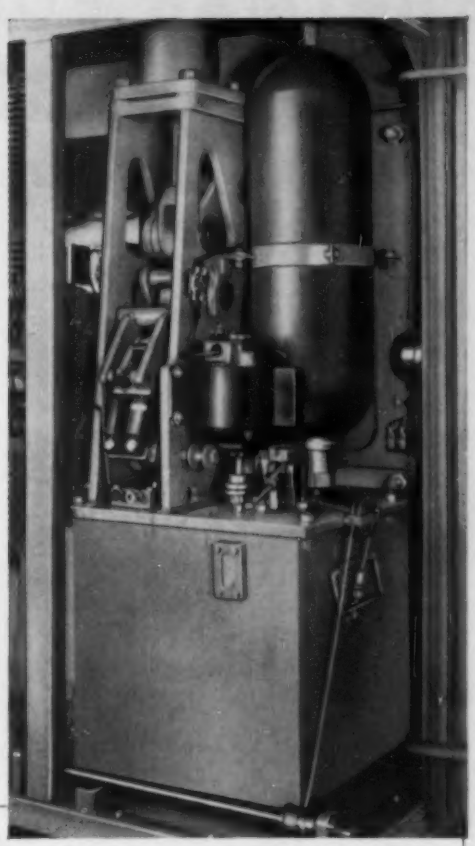


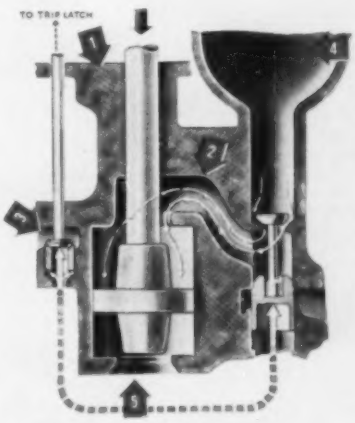
HYDRAULIC OPERATOR

TYPE OA

FOR HIGH VOLTAGE POWER CIRCUIT BREAKERS

FEDERAL PACIFIC Type OA Hydraulic Operating Mechanism is unmatched for smooth operation, precise motion control and low maintenance cost. The hydraulic power flow takes place in a solid block of steel, which is submerged in oil at atmospheric pressure. This eliminates power flow pipes and fittings, solves all leakage problems, gives high safety factor, and results in a simple, integrated design.





1. **Hydraulic power flow in rugged steel casting eliminates pipes and fittings.**
2. **Large, short oil duct eliminates shocks and surges.**
3. **Trip-free in any position of closing stroke. Speed and smoothness of action unsurpassed.**
4. **Accumulator charge easily checked while circuit breaker remains in service.**
5. **Plug below piston enters into this orifice to effect shock absorbing. Have six years experience with this type hydraulic component.**

For complete details, secure Catalog 587 from Pacific Switchgear Division, Federal Pacific Electric Company, 5815 Third Street, San Francisco, California.

FEDERAL PACIFIC
ELECTRIC COMPANY

MAIN OFFICE: 50 PARIS STREET • NEWARK 1, NEW JERSEY

Federal Pacific products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct, High Voltage Circuit Breakers and Power Switches ★ Sales offices in principal cities.

KUHLMAN POWER TRANSFORMERS

engineered for top performance... built for long life

Rigid, sturdy construction

1. Leads and lead guides well supported with sufficient electrical clearance.
2. Core clamps prevent shifting or vibration.
3. Pressure studs and steel clamping rings hold coils solidly in place.
4. Tank of heavy steel plate reinforced by fabricated channels.
5. Keyed radial spacers support, separate, and firmly anchor individual coils.
6. Heavy tie rods to resist short circuit and lifting forces.
7. Rigid insulating blocks between coil stack and steel clamping ring.

High electrical efficiency

8. Continuously wound coils with minimum electrical resistance and neat coil section connections.
9. End coils reinforced for surge protection.
10. Static shield for voltage stress equalization at high voltages.
11. Cable lead connections brazed or crimped.
12. Core of laminated oriented steel with cruciform cross section.

Coordinated insulation

13. Insulation barrier between high and low voltage windings.
14. Core insulation.
15. Barrier between high voltage coils.
16. Insulation between core yoke and coil stacks.
17. Detachable core grounding strap.

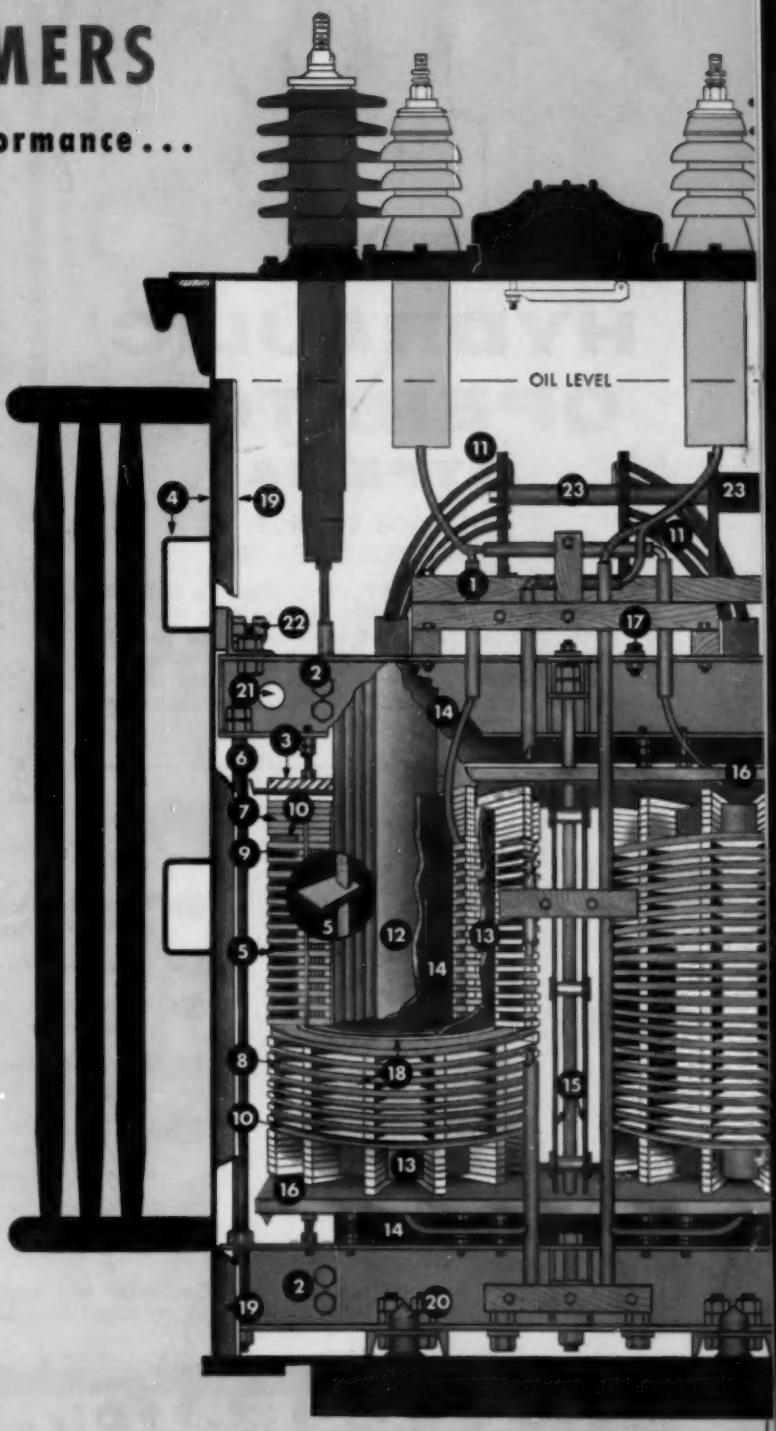
Entrapped moisture and air forced out by heat and vacuum treatment.

Good thermal protection

18. Large ducts formed by radial and vertical spacers assure good circulation to all parts of the windings; thus eliminating danger of "hot spots".

Accessible and easily handled

19. Guide for lowering core and coil into tank.
20. Pins for positioning core and coil.
21. Core clamp lifting eye.
22. Tank anchor bolt locks core and coil to tank.
23. Tap changer at top of core and coils for ease of inspection.



KUHLMAN

KUHLMAN ELECTRIC COMPANY

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA